RAILROAD GAZETTE

QUARTO VOL. XXIV.—NO. 34. A JOURNAL OF TRANSPORTATION ENGINEERING AND RAILROAD NEWS. THIRTY-SEVENTH YEAR.

NEW YORK: Published at 73 Broadway. FRIDAY, AUGUST 19, 1892. Entered at the Post Office at New York, N. Y., as Mail Matter of the Second Class.

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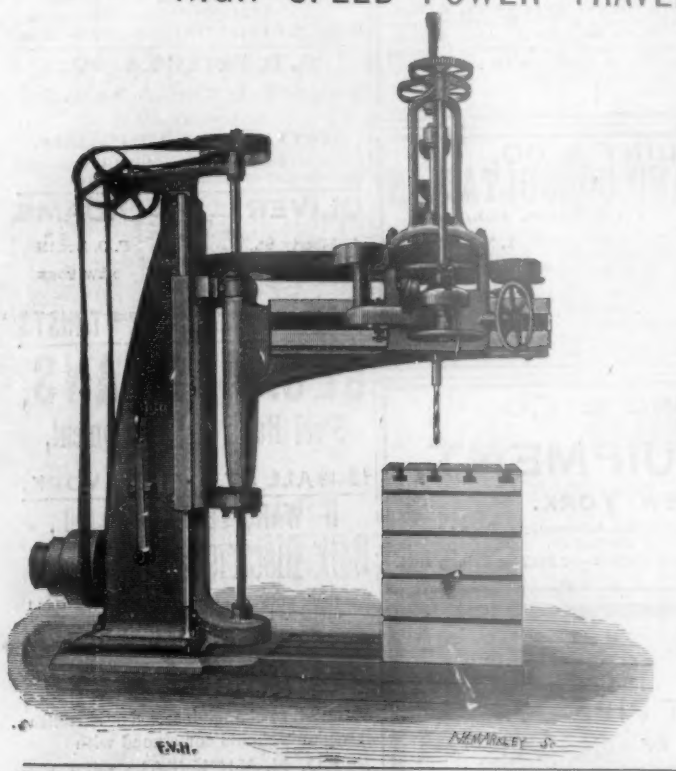

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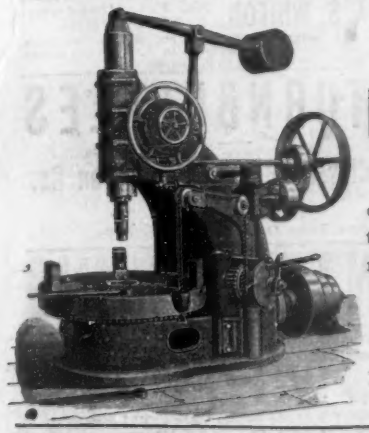

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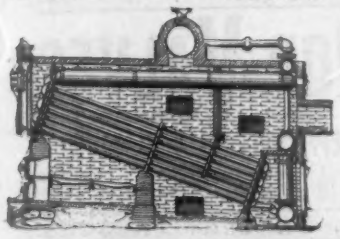

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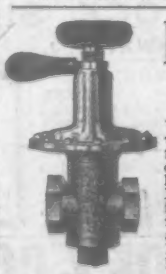

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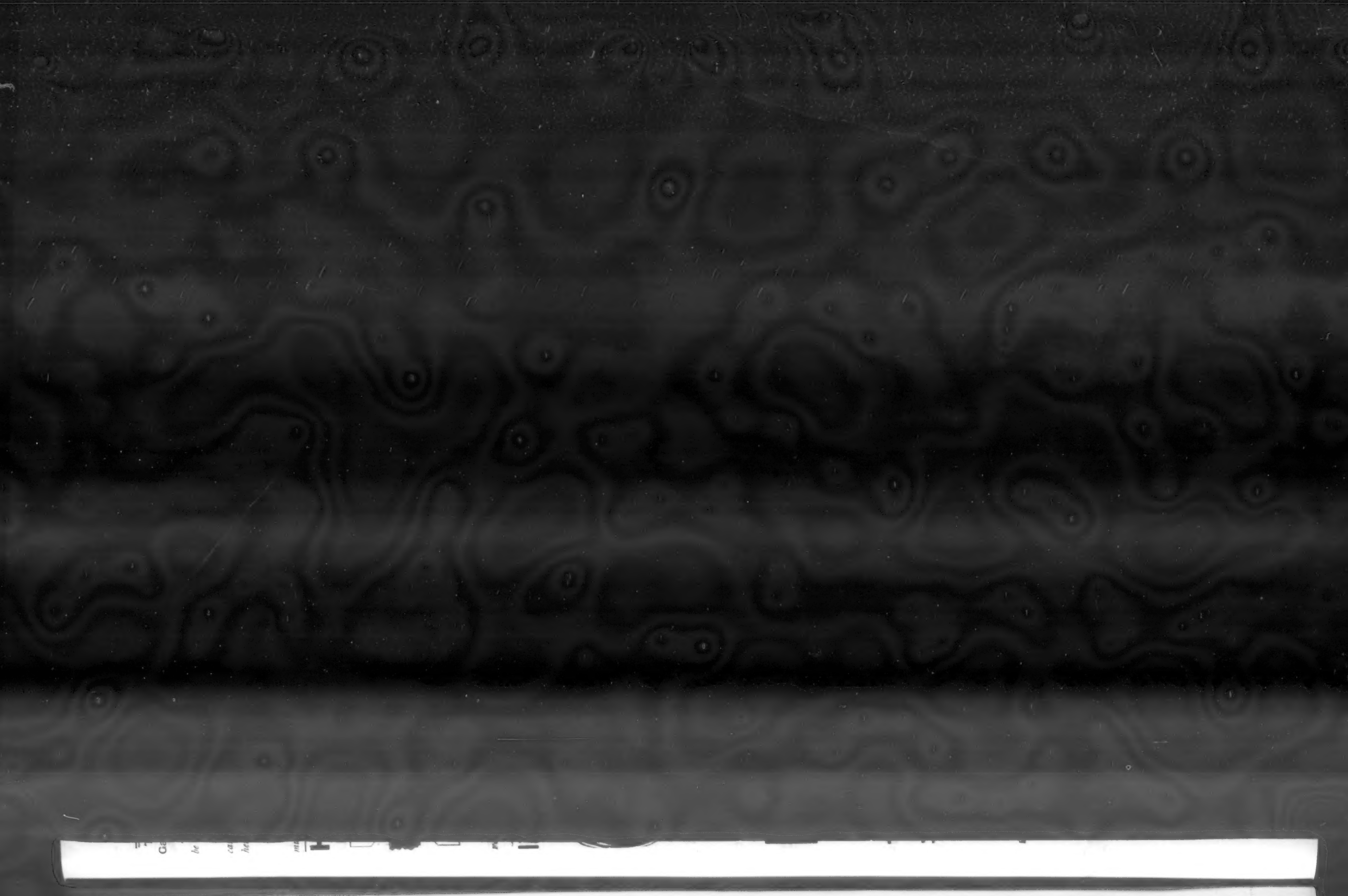

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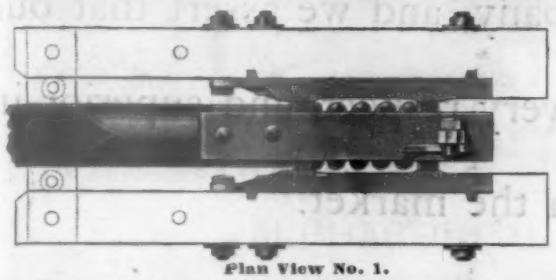

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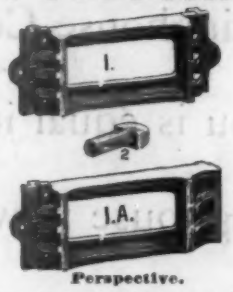
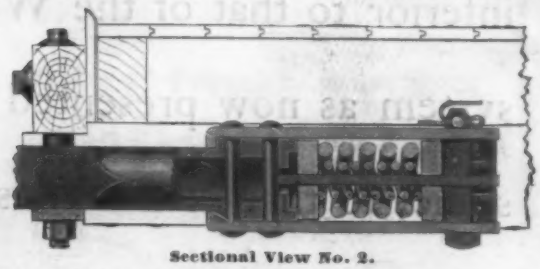


Perspective.



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Hunt, Robt. W. & Co., The. 1
Hutchins, C. B., & Sons

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Illinois Steel Co. 18
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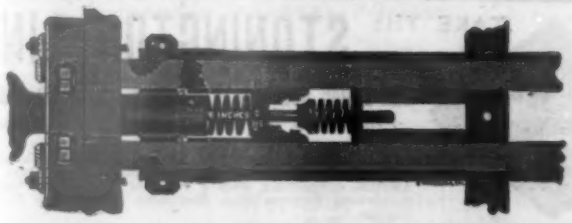

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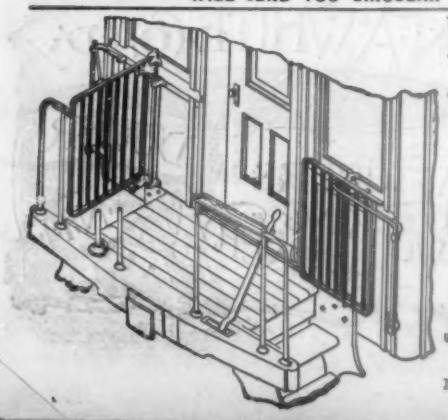

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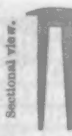

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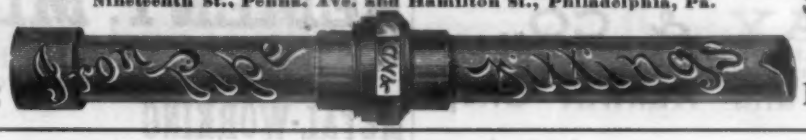

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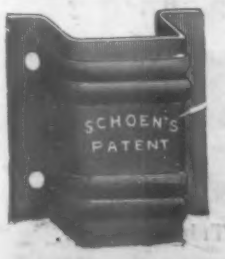

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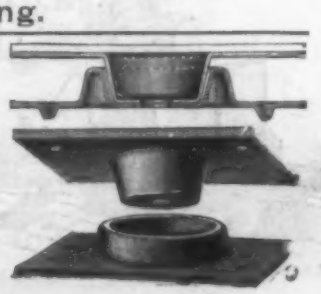

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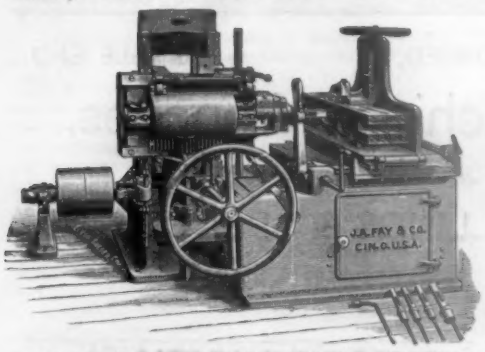

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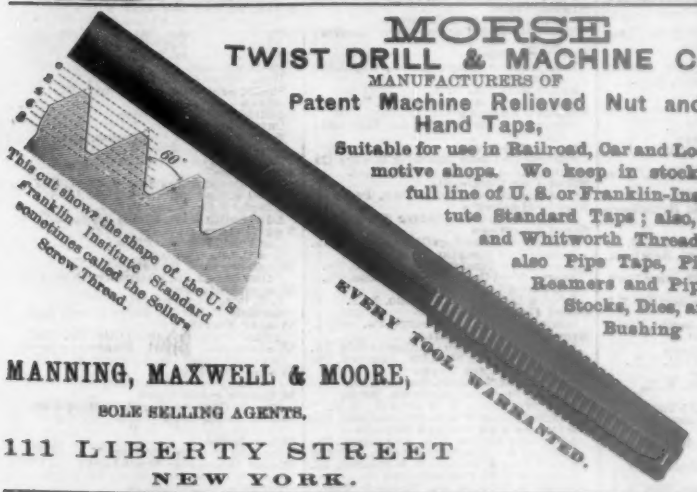
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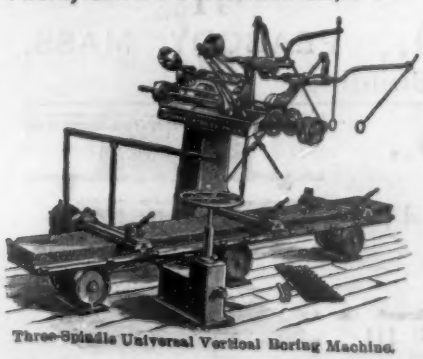

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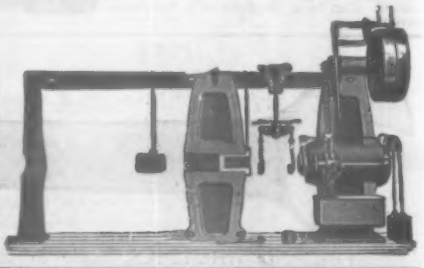

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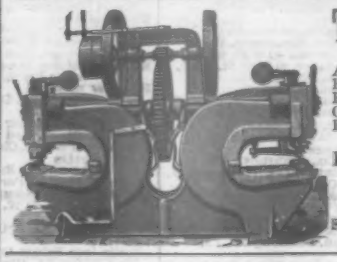

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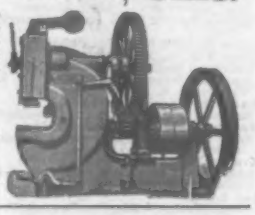

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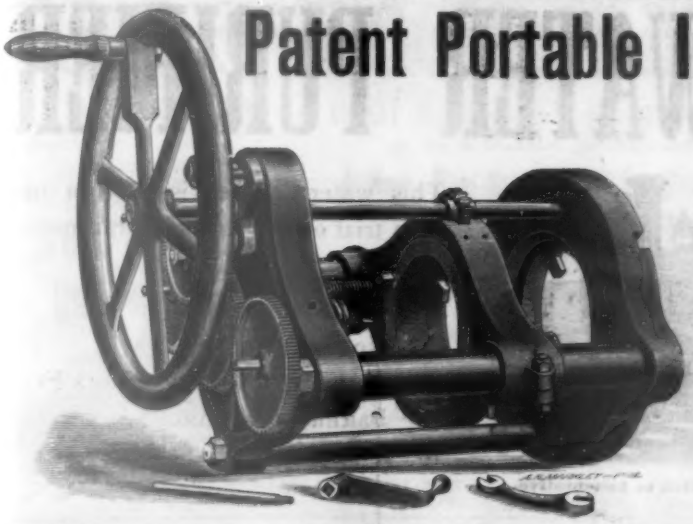

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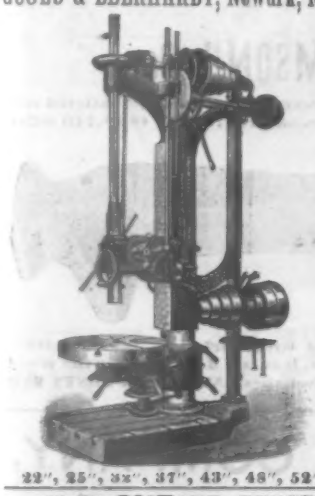

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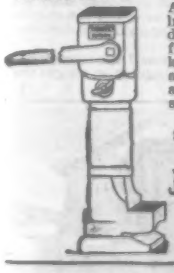

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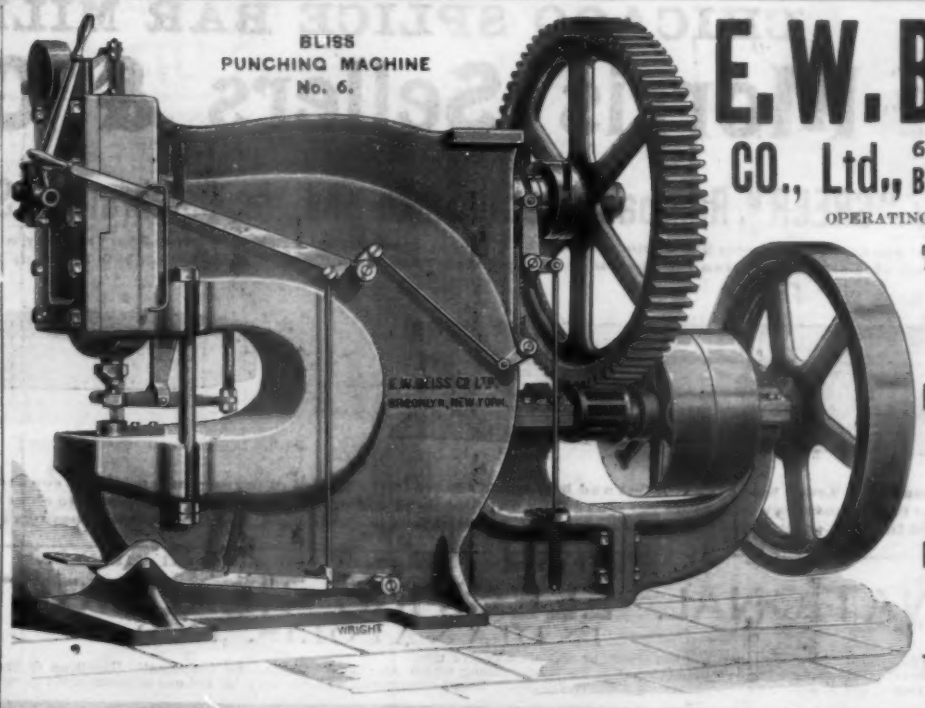

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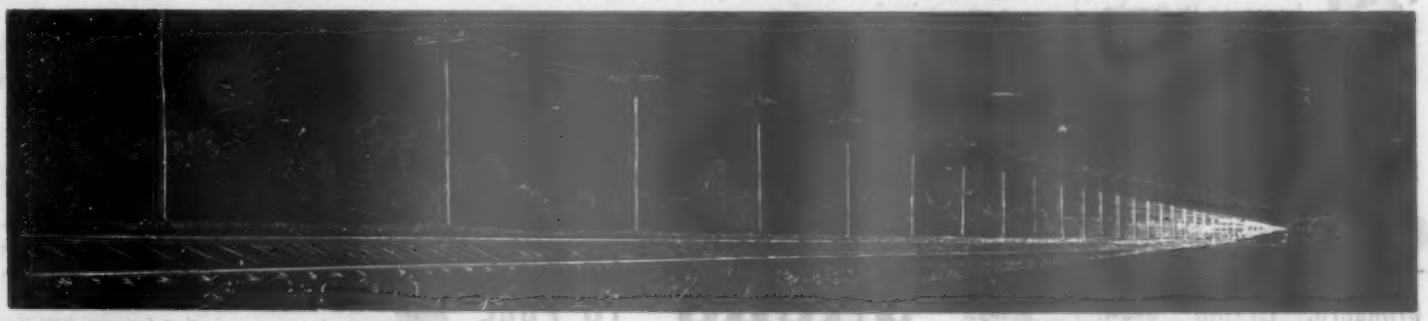

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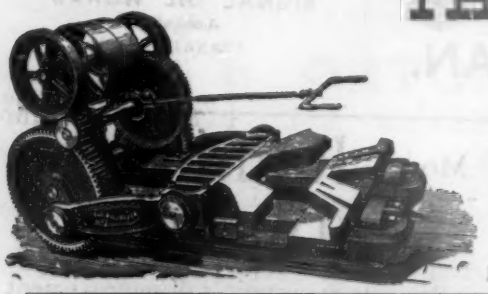

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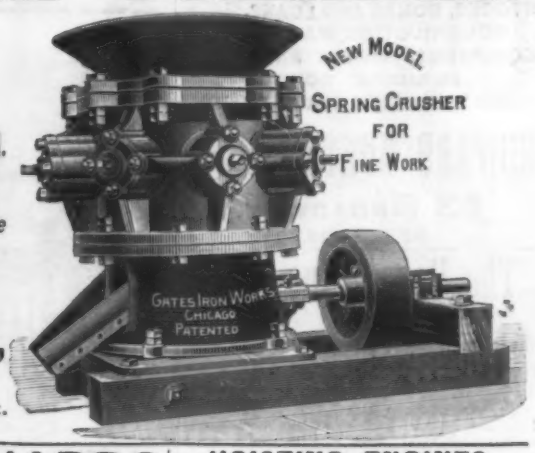

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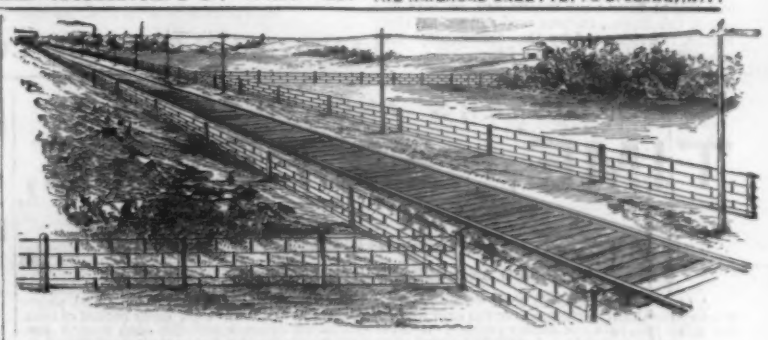

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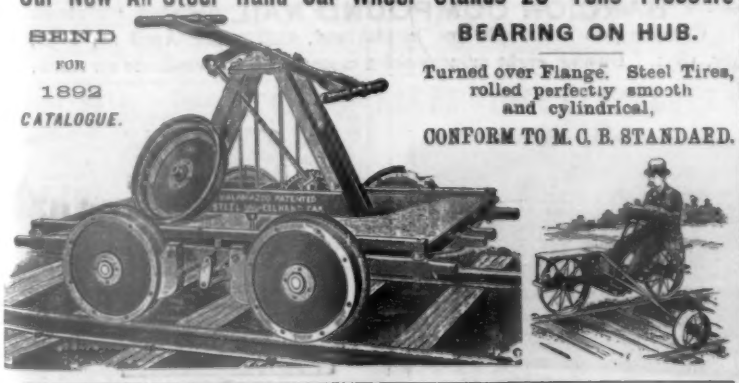

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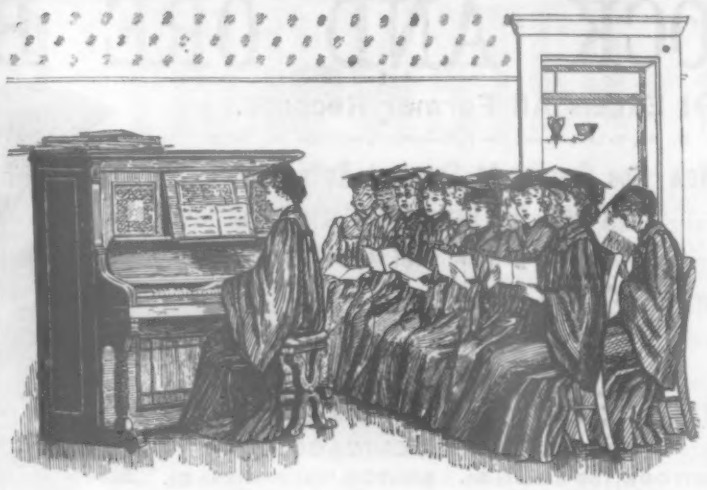

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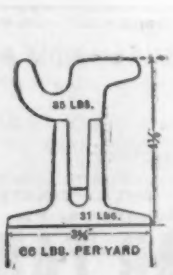

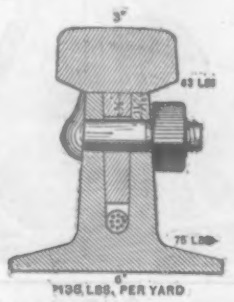

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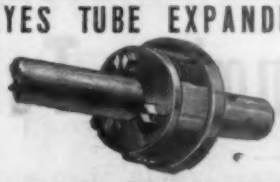
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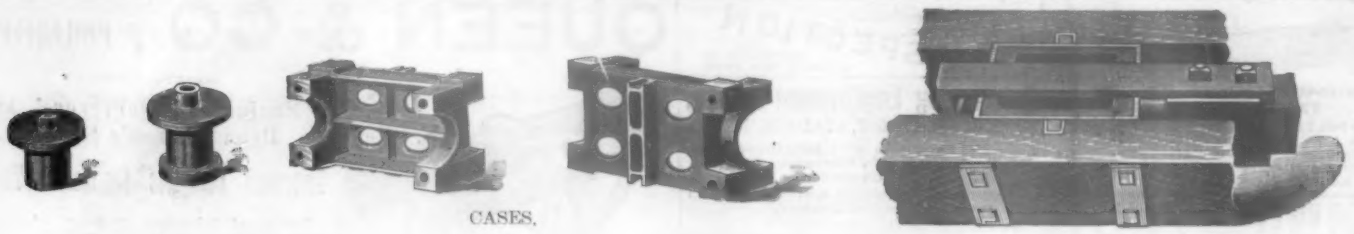

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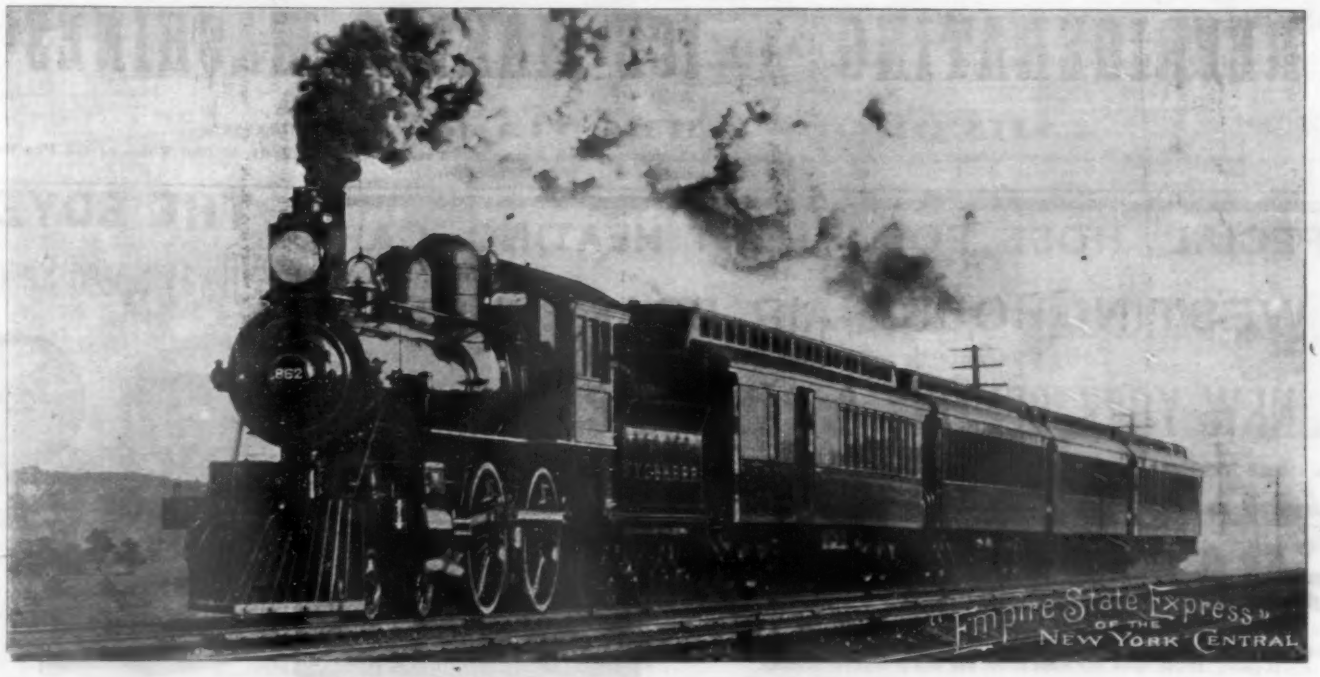

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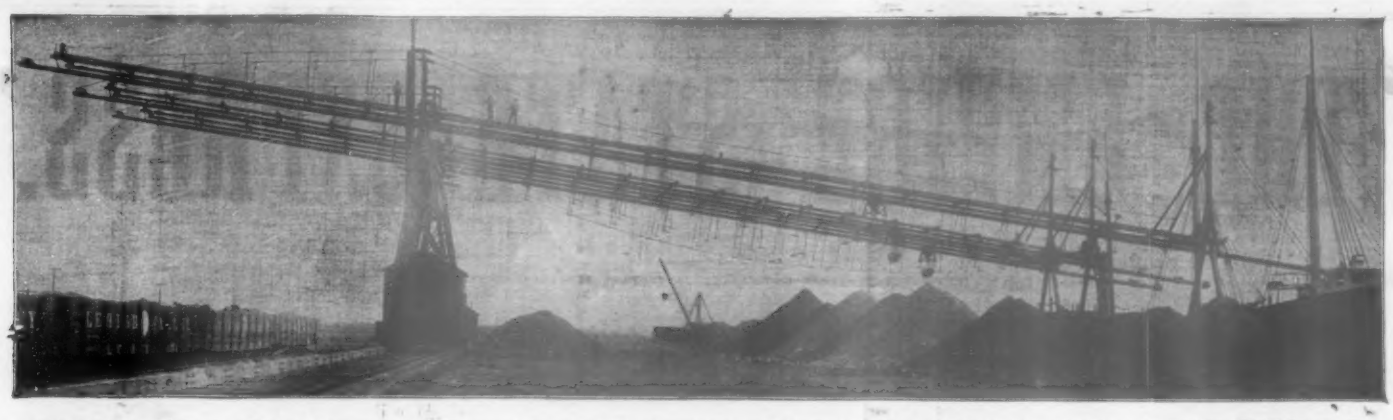

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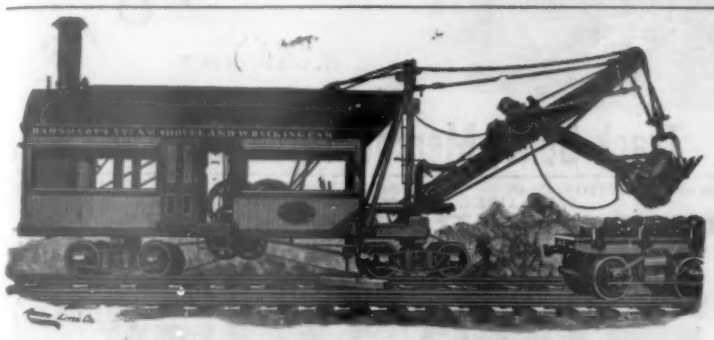

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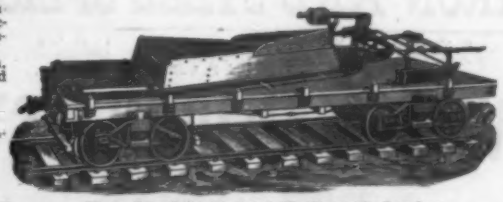

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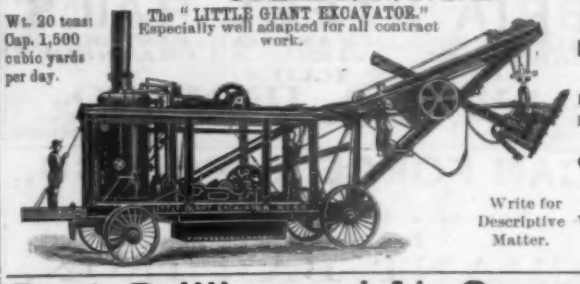

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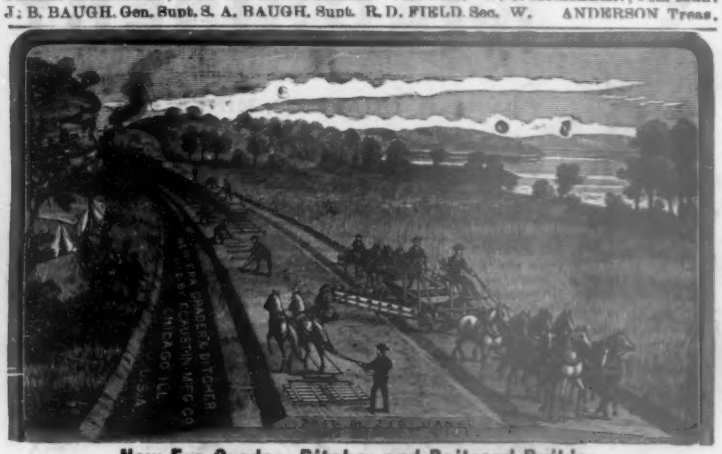

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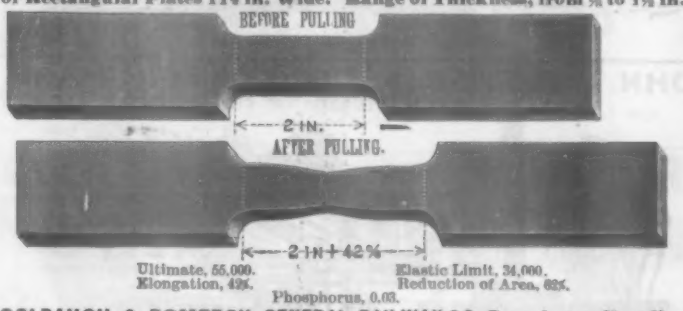

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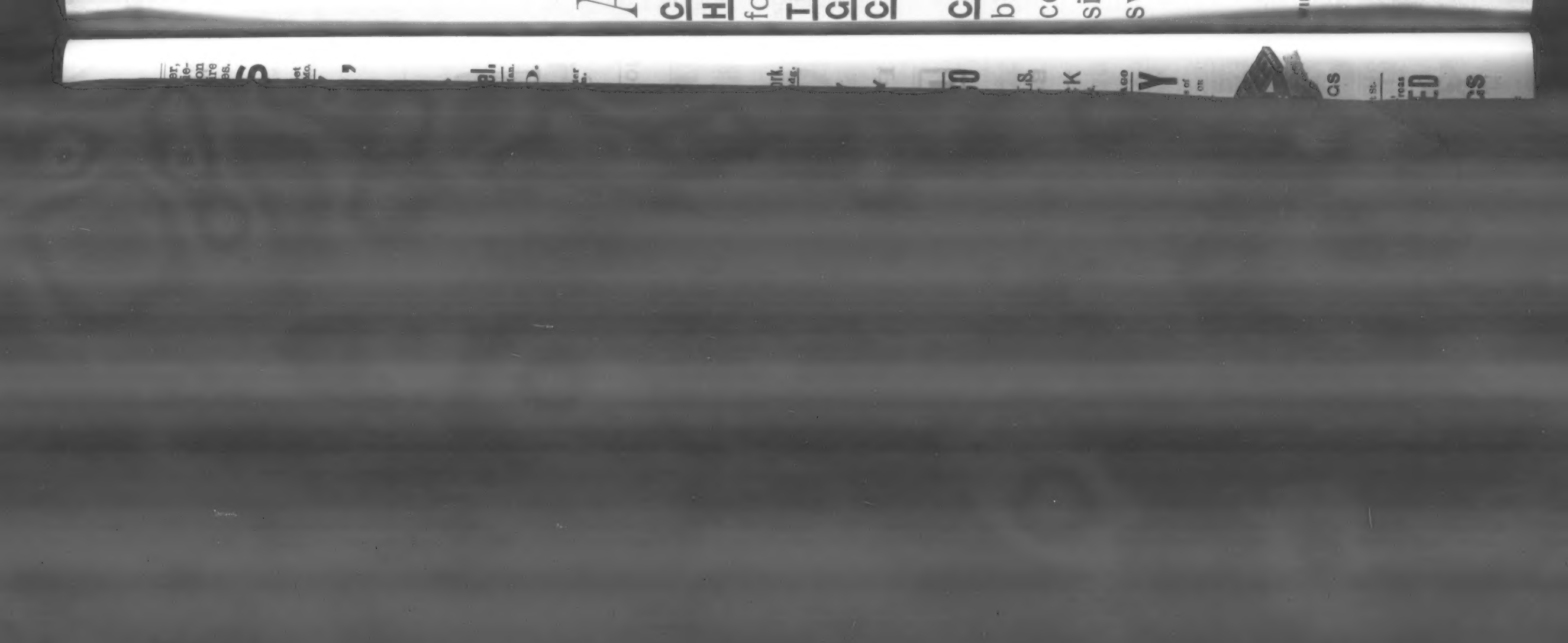

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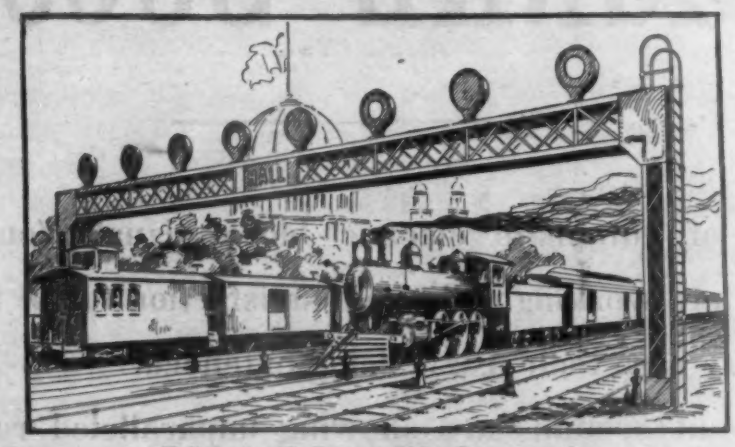

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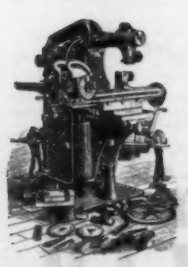
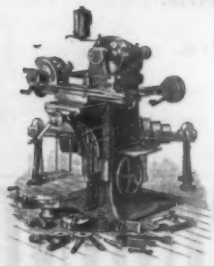

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RAILROAD GAZETTE

FRIDAY, AUGUST 19.

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Contributions.

The Goose and the Golden Egg.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The recent report of the Committee on "Cast Iron Wheels" to the Master Car Builders' Association is deserving of careful attention by railroad men, wheel makers and the general public. The conclusion which the committee reaches is especially worthy of attention. It is gracefully and gratefully put in these words:

"In conclusion your committee expresses briefly the opinion that the experiments made and being made in the distribution of metal by those connected with roads which have facilities for making experiments places the members of our body under obligation to them, and wheel makers are entitled to more credit than they now receive for the production of a cast iron wheel weighing less than 600 lbs. guaranteed to carry our largely increased loads, running 40 to 50 miles per hour for 60,000 miles, at a cost far below the price we pay for other parts of our car and locomotive castings. When we consider the remarkable progress in the manufacture of cast iron wheels, and how well the makers of such wheels have kept to the front, we admit that they are entitled to a large amount of credit."

Undoubtedly they are, but this is all they get. It is pretty much all credit and very little cash. Why should wheels be furnished at a cost far below that of other castings? Is there not a great danger hidden in such a state of things? To produce a wheel suitable for the travel and traffic of the day requires the very best material that can be produced, and the very best processes of manufacture. These cost money—more money than any other "car and locomotive castings." How then can they be honestly furnished at a less price? Does not the fact itself awaken suspicion?

The best makers may for a time be obliged, under the present system of purchasing supplies, to accept the price offered by the poorest and most unscrupulous, rather than close their works. But if this state of things is to continue, it is only a question of time when their works will close themselves. The alternative will then be the poorest wheel at the highest price, or the steel wheel at three times as much.

The wonderful result, of which the committee speaks, "600-lb. wheels running 40 to 50 miles per hour for 60,000 miles" has undoubtedly been obtained because of the physical tests, upon which almost all wheels are now purchased. At first these tests were considered very severe, and many wheel makers failed to meet them. But now many ways are known to the initiated, by which the most severe tests are easily met by those who care more for present cash than for lasting credit, and yet the wheels, in their material and in their manufacture, are not much, if, any, better intrinsically than they were before. The tests themselves put a limit to ambition. If a wheel just passes the inspection, the Purchasing Agent is bound to accept it, and if it exceeds the demand tenfold, he cannot, and will not, pay a farthing more for the extra quality.

If a clause could be added to the usual specifications, guaranteeing in some way a preference, after a reasonable time, to any maker whose work should uniformly exceed the required tests, it would certainly act as a great stimulant to procure even better results than the present best. And if this preference were given to the makers in the ratio of excess above the required specifications, it would not only raise the standard to be attained, even higher than at present, but in so doing it would reduce the expense of maintenance to the railroads, and insure greater safety to the public.

By the present system the goose which lays the golden egg is being gradually but surely strangled. Would it not be wiser to fatten him, even if he be but a goose, than to kill him?

INQUIRER.

The Railroads in Chicago.

CHICAGO, Aug. 10, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I was much interested in some articles which lately appeared in the *Railroad Gazette* with reference to the railroad problem in Chicago as presented by the report of the committee of the Western Society of Engineers, and you will not be surprised if I am forced to conclude that your article was written without due consideration of the local conditions as they exist to-day.

I am not the only engineer who believes that the matter of elevated railroads is much overdone and that other methods of avoiding grade crossings are unfortunately too much ignored by engineers generally. The reasons for this seem very apparent. The financial success and the mechanical success also, so far as it relates to safe travel, of the New York City elevated lines has given an impetus to that method of construction greater than it deserves, especially when it comes to being applied to standard lines of transportation, under conditions such as we have. Another element which enters much more largely into the problem I believe than any of us fully realize, is that of the large iron and bridge firms, who are interested in structures that will create a demand for their work and material. They have energetic and vigilant agents throughout the country and the natural tendency is to drift into those types of construction which most benefit manufacturing interests. A depressed way for railroads entering Chicago would require far less structural material of iron than elevated lines; it would also cost much less provided six to 12 tracks were brought in parallel. The work when completed would be lasting and the annual expense of drainage but a fraction of the cost of painting and maintaining iron structures; besides, iron structures are only temporary. There are other reasons which might be stated but which I cannot enter into here, as to why, in very many ways, a depressed system of tracks is greatly to be preferred.

As to the harbor problem, I am thoroughly convinced that the only satisfactory solution which will ever come will be in the way of an interior harbor, as distinguished from a lake front harbor. The reasons for this are set forth in the report, and as yet have never been successfully controverted. The thing, however, which will fully determine this solution is the work which the Sanitary District has in hand. The creation of a deep and wide channel connecting with the Chicago River, one mile and a half from the lake, will force a proper lake connection; when this is done we shall hear no more of an inadequate harbor for this city. Everything else relating to the terminal questions in Chicago, except the Sanitary District Channel, is merely in a state of agitation and talk. That is the only thing that has any actual existence, and it will become the determining element in the harbor problem, and in accordance with my views it will determine it right on all grounds. It is far easier and cheaper to connect water and rail transportation in the rear of the city than in the front.

X.

Publishing the Papers of the Am. Soc. C. E.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with interest the *Railroad Gazette* of Aug. 5 containing Mr. Thomson's vigorous letter and your own excellent comments on the matter of advance publication of the papers of the American Society of Civil Engineers. Perhaps you can find space for a few words expressing my notions on the subject.

The editor of the technical journal is bound to present the essence of all good articles in the Society *Transactions* in order to make his paper useful and attractive to the readers; and on the other hand, the reader wants the information *soon*. One point can be made which has not yet been touched, viz.: The student or seeker after knowledge should have also the benefit of the discussion, as in this will usually be found the test of the value of the facts or theories presented, since it contains the record of the impressions made by the paper upon those who have personally given the subject careful attention or thought, or who ask questions which may have escaped the notice of the author; also, because it contains the author's review of the whole matter after the fire of the critics. In this process the "wheat" is usually threshed out, and the reader who takes up the question afterward gets the benefit of the whole work. For this reason I would prefer that editors of technical journals shall publish only abstracts of the papers at the time of their presentation, so as to announce to their readers what is going on in the world, and give those who are in a hurry for the particular information the opportunity to write for a copy of the paper to the author, or to the Secretary of the Society without delay; then after the paper has been fully discussed and published, let the editors print the whole paper with the discussion complete or condensed as may be expedient.

By this process we get news and education. The publication of a paper without the discussion is practically only an advertisement of the author, which may be very gratifying to him, but is of little value ordinarily to the student, who must lose the time needed to hunt up the matter and re-read it after former publication. Many times have I gone through this experience, and have been tempted to use cuss words. In many cases, also, the discussion is much more valuable than the original paper and brings out important collateral facts. The paper and discussion should always go together like a cup and saucer; each is incomplete without the other. Therefore the chief reason, in my mind, for the publication only of an abstract at the time of reading.

Every student has doubtless had the same misery as myself in pursuing the thread of some argument or debate which runs through several numbers of a paper at irregular intervals. Let us have all of the facts collected together and given in a single dose, or consecutive doses, instead of being obliged to work the usually incomplete indexes of unwieldly volumes, and having to lose much valuable time. Were this done by the technical journals to a larger extent the inducement to keep them would be vastly greater.

AN ENGINEER.

Completion of the Four-Mile Tunnel for the Chicago Water Works.

About four years ago the city of Chicago found it necessary to increase the capacity of its water system in order to supply the needs of the rapidly growing outlying districts. To meet the demand and to procure an uncontaminated water supply, it would have to build a tunnel under Lake Michigan. The tunnel was originally planned to extend to a point four miles out into Lake Michigan, opposite Peck Court. When the first shaft was sunk on the lake front park, opposite Peck Court, it was found that the borings made by the city were inaccurate, and could not be relied upon. New borings were made on the proposed route of the tunnel, and it was found necessary to alter the course of the tunnel, as many water bearing strata were found to exist. The first shaft sunk was abandoned as a working shaft, and the tunnel was driven south from from this shaft to a point near Park Row, where the main shaft was sunk and from which operations were then carried on.

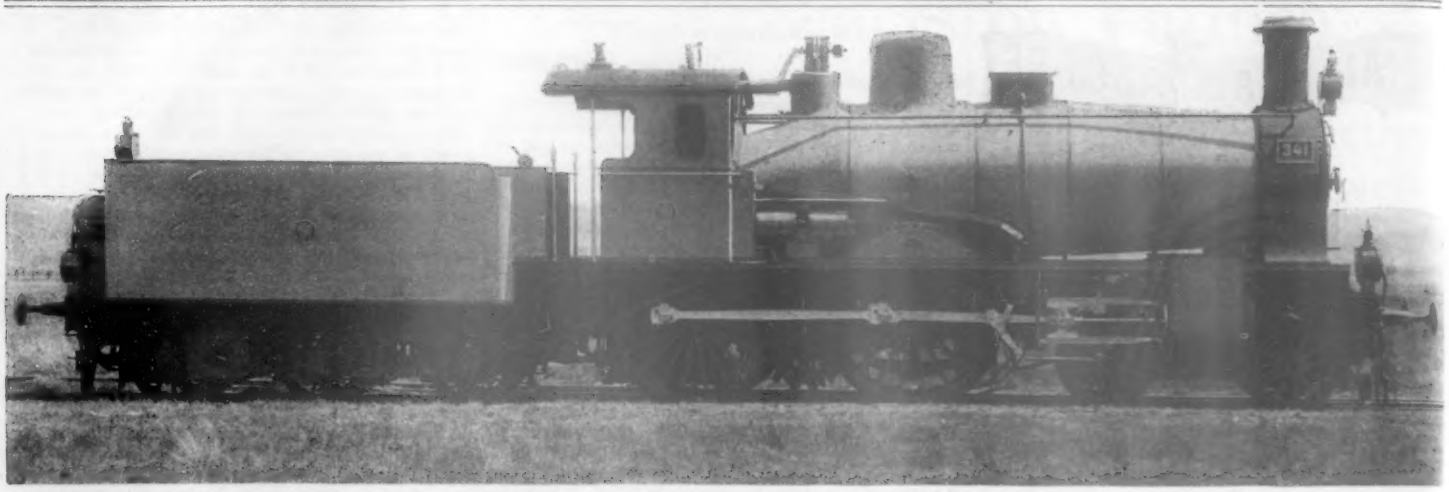
The information derived from the second set of borings indicated that the revised plan for the tunnel could not be fully carried out, and that it would be necessary to modify the plan as the work progressed. The work in the tunnel corroborated the information derived from the second series of borings. The original plan was an 8-ft. tunnel from the shore shaft to the four-mile crib. After driving the 8-ft. tunnel a short distance under the lake from the Park Row shaft, it was found necessary to change the plans and build two 6-ft. tunnels, as it was impossible to build an 8-ft. tunnel through the soil encountered. These 6-ft. tunnels were continued 2¼ miles from the shore shaft, where they were joined again in an 8-foot tunnel. At this point a crib had been provided in order to expedite the work, it being the intention of the contractor to work both ways from this shaft. The nature of the soil encountered at this shaft was such that it was found impossible to continue the work as outlined, and this crib was abandoned. The course of the tunnel was changed, and a detour was made around this particularly bad spot of soft blue clay, and the use of an intermediate shaft was abandoned altogether.

The four-mile crib and shaft having been completed, work progressed in both directions very rapidly, and a few weeks ago the tunnel was completed, the shore end and the water end meeting at a point about 500 ft. east of the original 2¼ mile crib. Owing to the great number of unforeseen difficulties, the work on the tunnel was delayed to such an extent that it was found necessary to provide water temporarily for the relief of the south side of the city. A land tunnel had been built connecting the shaft at Peck Court with the land tunnel supplying the west side pumping works. A by-pass was constructed around the shaft at Park Row, and the new Fourteenth street pumping works were supplied with water through a land tunnel from the original city tunnel on the north side, the connection being made near the west side works. The new four-mile tunnel and its connections will be ready for service in a few weeks.

The contractor who built this tunnel was put to much extra expense not provided for in his original contract with the city, and on turning the tunnel over to the city, a bill was presented for extra labor and material amounting to nearly $250,000. The city has contested this claim, and in order to adjust it a board of arbitrators was appointed, and their investigation has brought out much interesting testimony regarding the methods of prosecuting this work. There have been so many changes in the city government during the construction of this work that it was hard to get any connected account regarding the dealings of the city with contractor. All the testimony in the case is now in, and arguments for the city and the contractors were commenced this week.

The Switchmen's Strike at Buffalo.

The yard brakemen and conductors, otherwise known as switchmen, working for the Erie, the Lehigh Valley and the Buffalo Creek railroads in the city of Buffalo, struck on the night of Aug. 12 for and an increase of pay, and their action was soon followed by incendiarism and violence, which destroyed probably $100,000 worth of railroad property. The strike leaders denied complicity in these lawless acts, but their denial was a faint one, and a railroad officer claims to know that they discussed violence at their meeting before the



EXPRESS LOCOMOTIVE WITH LENTZ STAYLESS BOILER—PRUSSIAN STATE RAILROADS: COLOGNE DIRECTORY.

Built at the HOHENZOLLERN LOCOMOTIVE WORKS. *Designed by* GUSTAVE LENTZ, *Civil Engineer.*

strike. The conductors have been getting $65 a month for day work and $70 for night work, the brakemen receiving $5 less in each case. The strike seems to be based on some change in the basis of payment which was adopted by the roads about two months ago on the enactment of the New York State law, requiring extra pay for overtime. It is claimed that the new basis increases the work without increasing the pay. The reports are vague, however, and nothing is said about any negotiations with the railroad officers. Before the public had any inkling of the merits of the strike the dispatches told of fires and malicious derailments, which at once overshadowed any grievances the men may have had. On Sunday morning, about 2 o'clock, three fires were started in the Lehigh Valley yards among the cars, and simultaneously a string of cars was run down the incline from a coal trestle, and they wrecked a tank and a locomotive. Two old passenger cars were also fired. Cars were maliciously derailed at various points in both the Lehigh Valley and the Erie yards, pins were pulled and trains disabled on the main tracks, and peaceable workmen were maltreated in a few cases. On Sunday evening an Erie passenger train was derailed by the malicious misplacement of a switch under it. The same night more fires were set. On Monday night it was reported that the Lehigh Valley had lost 70 and the Erie 14 cars by fire, many of them loaded.

On Tuesday it was said that new fires Monday night had done further damage, and one report estimated a total loss of 250 cars. On Monday 40 green sheriffs surrendered to the mob at Cheektowaga, outside the limits of Buffalo, and the head sheriff then called upon the state militia, several companies of which were sent out from Buffalo that night. Incoming passenger trains were boarded when they stopped for crossings and passengers suspected of being new workmen were driven from the cars.

At Sayre, Pa., 50 of the yardmen of the Lehigh Valley struck on Monday, and the sheriff was resisted in his attempts to protect railroad officers in moving trains. The Philadelphia & Reading, which controls the Lehigh Valley, gathered 50 men to take the place of the strikers and started them from Philadelphia for Buffalo on Monday night, and on Tuesday sent 100 more; and President McLeod offered a reward of $5,000 for the detection of anyone molesting employés or injuring the road's property.

During Tuesday and Wednesday the police guarded the railroad premises in Buffalo, and the militia, several hundred strong, performed the same service east of the city limits. During the day, Tuesday, matters were generally quiet, but in the evening the mob, mostly strikers, threw stones at the soldiers and refused to disperse, and was finally broken up by the vigorous use of clubs by the police and bayonets by the soldiers. There were three conflicts during the evening. The railroads succeeded in keeping some freight moving, but with much difficulty. Some of the strikers uncoupled cars at Alden, 25 miles east of Buffalo.

On Wednesday some or all of the New York Central switchmen struck, and on Wednesday night it was reported that those on the West Shore and the Lake Shore & Michigan Southern had left their work. Those on the Buffalo, Rochester & Pittsburgh left work even after the road had acceded to the demands which they suddenly made on Tuesday. It was estimated Wednesday night that about 2,000 soldiers were in and around Buffalo. The number of strikers has not been stated; the total number of day switching engines on the New York Central is 25. It appears that the strike only partially stopped business on that road. The Lehigh Valley was blocked at Sayre, Pa., as well as at Buffalo, but expected to get trains out with new men on Thursday. The State Board of Arbitration went to Buffalo, but accomplished nothing.

The men, of course, were willing to arbitrate, and the companies, of course, were not.

Express Locomotive With Stayless Boiler.

In our issue of Jan. 9, 1891, appeared diagrams and descriptions of locomotives with stayless boilers, built from the designs of Mr. Gustave Lentz, lately Managing Director of the Hohenzollern Locomotive Works, Germany. The illustration given herewith is of an express locomotive built for the Cologne "Direction" of the Prussian State Railroads, at the Hohenzollern Works, from the designs of Mr. Lentz. The principal dimensions and weights are as follows:

Cylinders, diameter	16.9 in.
Stroke	23.6 in.
Driving wheels, diameter	6 ft. 5 in.
Truck " "	38.6 in.
Total wheelbase	21 ft. 7 in.
Tubes, number	256
Tubes, diameter	1.6 in and 1.8 in.
Grate area	10.76 sq. ft.
Total heating surface	1,120.6 sq. ft.
Boiler pressure	14 atmospheres.
Total adhesion weight	61,600 lbs.
Weight of engine, empty	91,600 lbs.
Weight of engine, working order	110,000 lbs.
Weight of tender, empty	35,000 lbs.
Weight of tender, working order	79,000 lbs

The shell consists of two truncated cones with a cylindrical part in the middle and an inside corrugated firebox so arranged that the ends of the boiler are of smaller diameter than the middle portion. The top is inclined from the middle toward the ends, the greatest steam space being approximately in the middle of the length of the boiler. As the tubes are sufficient to stay the tube plates, no further stays are necessary. The firebox is divided into two nearly equal parts by a fire bridge which has an opening of a half circle. The gases from the fuel are mixed at the fire bridge with hot air and are consumed in the combustion chamber beyond.

The air for combustion of the gases above the fire enters the firebox partly through the fire door casting and partly through the lower part e bridge, so that from above and below hot air enters and mixes with the gases. At the rear end of the boiler, in the cab, is a small dome for the boiler fittings.

The Care of Locomotive Boilers in Algeria.

BY C. J. BATES, C. E., M. E.

(*Continued from page 550.*)

It often occurs that corrosions are formed, as shown in fig. 13, along the rivets. They occur in the curves in the neighborhood of the longitudinal seams, due to the imperfect form of the ring. This can be remedied either by placing the rivets in the top of the cylindrical part, in the steam by adopting a scarfing with joints; the section of a ring then shows two perfectly concentric circumferences; fig. 14 shows the arrangement of the cylindrical part with the rivets in the steam; the joint of the collar of the dome, situated in the plane passing diametrically through the axis of the boiler and the axis of the dome, is placed between the plate reinforcing the hole pierced in the boiler and the seat of the dome; and thus obtain a combination very resisting and avoid a seam that would otherwise be placed in the water.

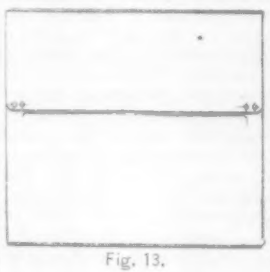


Fig. 13.

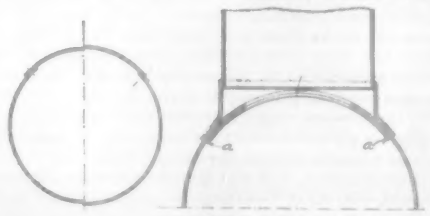


Fig. 14.

The rapid wear of the staybolts and the walls of the base of the grate box has already been mentioned; they hold, according to their construction, the very adhesive deposits, composed of sulphate of lime, to the interior of the plates. This necessitates replacing the staybolts quite frequently. The number of staybolts to be replaced, and consequently the holes to be drilled to remove them, often becomes considerable, and we are led to seek a way to replace the hand boring by machine work. Portable drills, belted or moved by a flexible shaft, sometimes take longer to set in place for work than to drill the holes, especially when they require to be in the grate box of an engine occupying an ordinary position. This fact has led to the use of a special machine of which the arrangement is shown by fig. 15.

This machine is placed in a pit under a track devoted to repairs. The engines, mounted on their wheels, if new staybolts are to be put into the grate box only, or else on a special car and on the front axle if a more important repair is needed, are brought above the drilling machine. There the drill can be moved as needed to the track and raised so as to operate on whatever one of the exterior or interior faces of the firebox needs it. The holes are drilled from the interior of the grate box to the exterior of the firebox in vertical lines. In order to keep on the same line from one hole to another, the column which carries the head of the machine is raised or lowered. On the head is mounted a drill on a horizontal axis. In order to pass from one line to the following, on the right or left faces, it is necessary to advance or draw back the engine. In order to pass from one line to the other on the faces in front and back of the grate box, the drill must be moved.

Fig. 16.

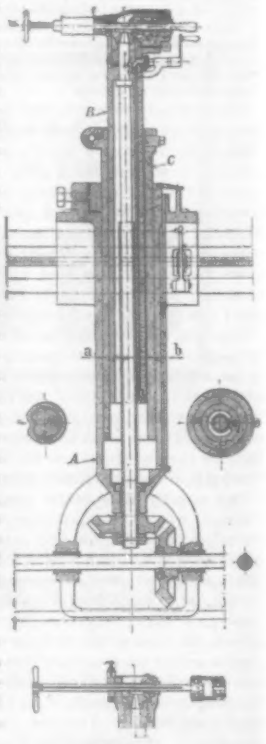


Fig 17.

Fig. 16 shows the arrangements by which the above movements can be made. They are composed of three vertical tubes fitted one into the other like a telescope.

The lower tube *A* is cast to a carriage movable in a direction perpendicular to the repair track; the upper tube of bronze *B* carries on its end a drill and a horizontal axis, while the intermediate tube *C* serves for lengthening. Movement is given by two shafts, one solid and the other hollow; the former is placed in the latter in the axis of the concentric columns. The solid shaft is jointed to the bronze tube, the end of which forms a pedestal and carries a conical toothed wheel into which is meshed a similar wheel which operates the boring head of the drill. This is arranged to turn around the head of the bronze column, the two pinions remaining in gear, a set screw being used to hold the drill in any position desired. The drill can, therefore, be applied to any of the faces of the firebox.

The hollow shaft is fastened to the lower column, which forms a frame and of which the base serves as a

pedestal. It carries on its end a bevel wheel which engages a pinion sliding on a shaft so as to transmit power and permit the movement of the machine and the cross frame.

Independent of the movement of the machine perpendicular to the track and of the movement of the hollow in the solid shaft, the power is transmitted to the drill or tap, for the drill machine may be replaced by a tool for tapping, fig. 17.

If done by hand a ratchet drill is used; in estimating the time taken twenty-five minutes per staybolt is allowed. Done by machine it requires five or six minutes, that is to say, from one-fourth to one fifth the time. It is the same for tapping; the operation by hand requires from eight to nine minutes, by machine less than three minutes, that is, three or four times as quick, and without fatigue to the workman who is in charge.

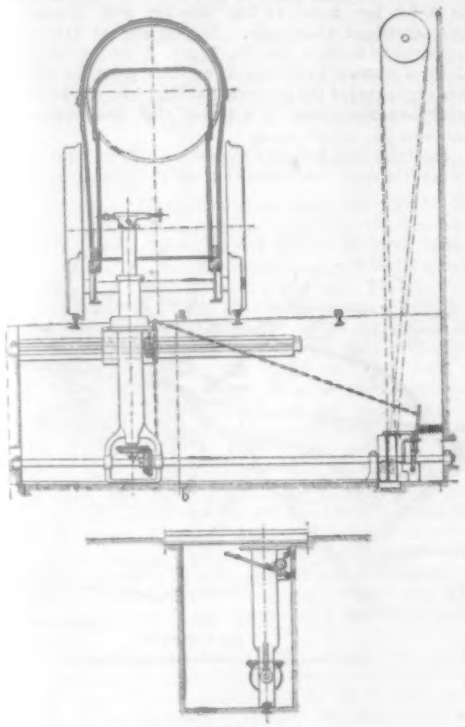


Fig 15.

The drilling of the staybolts can be simplified when it is possible to install in the workshop a transfer table. In this case the engine is supported by a small special car and can be taken to any position desired with reference to the drill. In order to pass from one row of staybolts to the following on the lateral faces, inside or outside, as in the first case, the engine may be advanced or drawn back, and in order to pass from one row to the other on the faces of the front and back it is necessary to advance or draw back the transfer table.

We have already shown that tubes that formerly had to be taken out at the end of 30,000 or 50,000 miles can now be used for 90,000 to 120,000 miles. This result is due to the influence of the arches of refractory bricks in the firebox and to the better washing obtained with more autoclaves and a jet of water at high pressure. Experience proves also that the firebox can be used a much longer distance than formerly, but as each of these repairs with the modification indicated has not reached the end of its usefulness, it is impossible to tell just how long they will last. Formerly the fireboxes were used up after 100,000 to 120,000 miles by the deposits of Algeria, and 120,000 to 150,000 miles by the deposits of Oran and Philippeville. To-day the old fireboxes, of which the staybolts have been kept sound and of which the scale has been cleaned from the base of the grate box when new staybolts were put in, have sensibly extended these numbers, so we may hope with the stay tubes to reach 200,000 or perhaps 240,000 miles.

Deep fireboxes, repaired with copper, thicker at the points where the wear is the greatest, and tube sheets reinforced, act well; the tightness of the staybolts is better assured by the greater length of screw in the thicker walls of the grate box; the angles of the plates, at the front and back, of which the curvature has been widened, show none of the wrinkles in which the cracks start when the radius of curvature is too small.

Many of these fireboxes have already had the staybolts once renewed near the grate after a distance varying from 60,000 to 90,000 miles. The greatest wear on the faces of the firebox is about .04 in. at the points where the thickness has been increased to .79 in. if the same obtains throughout (there is no reason that it should be otherwise) the fireboxes would last over 700,000 miles before being used up. They are practically used up when the thickness is reduced to .28 or .32 of an inch; then they are about in the condition of the firebox of a boiler fed with good water.

Milan Electric Exhibition.

Milan, Italy, is to have an international electric exhibition next year. Preliminary preparations for it are said to be now in progress.

Notes on British Train Speeds.*

II.

THE MANCHESTER, SHEFFIELD & LINCOLNSHIRE.

Generalities on Train Service.—The M., S. & L. is a small system connecting with the Great Northern at Retford, and enabling that company to put itself in communication with Manchester and Liverpool. Train services are generally good, especially the fast 4¼ hours Manchester expresses, which compete with similar trains run by the Midland and North Western companies over shorter routes from London. A noteworthy feature of this line is the really superb service of hourly expresses between Manchester and Liverpool, particulars of which, as well as of the services between Manchester and the principle points of the system, will be found set forth in the table below:—

Between Manchester and—	Distance.	No. of trains at or over 40 miles per hour		Fastest.	
		From Manchester.	To Manchester.		
	Miles.			Hrs.	Min
Warrington	15¾	20	19	0	18
Southport	49½	1	2	1	0
Liverpool	34	17	17	0	40
Sheffield	41¼	2	1	0	58

The best booked timings on the system are those of the Manchester to Liverpool hourly expresses which are timed to stop in Warrington 18 minutes after leaving Manchester (15¾ miles). Some trains run through from Manchester to Liverpool and vice versa without stop in 40 minutes (34 miles). On the eastern part of the system gradients are very severe between Manchester and Sheffield, and this prevents anything greatly above 40 miles an hour. Eastward of Sheffield, on an undulating road, about 48 to 50 miles an hour is often met with.

Locomotives and Train Loads.—This company uses two very dissimilar types for its express work. The coupled type generally works on the harder grades, while the "singles" work the Liverpool to Manchester express. Dimensions are as under:

Dimensions.	Single.	Coupled.
Diameter of drivers	7 ft. 6 in.	6 ft. 9 in.
Cylinders, in	17½ by 26	18 by 26
Heating surface (tubes), sq. ft.	1,057	1,179
" " (firebox), sq. ft.	87	99
" " (total), sq. ft.	1,144	1,278
Grate area, sq. ft	17	18.85
Weight on drivers or coupled wheels, tons, cwts.	17 t. 11 c.	32 t. 1 c.
Total weight, working order, tons, cwts.	49 t. 12 c.	46 t. 0 c.

Train loads are never very heavy. The fastest trains from London to Manchester are rarely over 100 to 120 tons in weight. The Liverpool to Manchester expresses are generally slightly over this weight. Punctuality is good by the best trains.

Actual Performances (with particulars of gradients).—Below we give examples of a fast start to stop run from Manchester to Warrington, and another fast stretch from Grantham to Retford:

SEVEN FT. SIX IN. "SINGLE," NO. 501.
With 11 coaches (132 tons).

Station.	Distance.	Time due.	Time, actual.		
	Miles.	p. m.	Hrs.	Mins.	Secs.
Manchester		7:30	7	20	33
Urmston	5	.....	7	27	11
Flixton	6¼	.....	7	38	24
Irlam	8¼	.....	7	40	30
Glazebrook	9½	.....	7	41	45
Padgate	13¾	.....	7	46	6
Warrington	15¾	7:48	7	48	16

SIX FT. NINE IN. COUPLED, NO. 561.
With eight coaches (96 tons).

Station.	Distance.	Time due.	Time, actual.		
	Miles.	p. m.	Hrs.	Mins.	Secs.
Grantham		4:04	4	0	30
Barkstone	6¼	.....	4	11	55
Hougham	6¾	.....	4	13	32
Claypole	10	.....	4	16	54
Newark	14¾	.....	4	21	7
Carlton	21	.....	4	26	54
Crowpark	22	.....	4	27	52
Tuxford	26½	.....	4	32	54
Retford (Dead slow through station).	33¼	4:40 (to pass)	4	40	18

The gradients between Manchester and Warrington are very easy, and between Grantham and Retford the line descends gently nearly all the way, finishing up with about five miles of 1 in 200 rising.

THE GREAT NORTHERN.

Generalites on Train Services.—The Great Northern is one of the three great trunk routes leading to the North from London. Though much smaller in point of mileage than its rivals, the London & North Western and Midland, it enjoys from a speed point of view a higher reputation than either of them, and its services to Manchester and Sheffield (in which it has the assistance of Manchester, Sheffield & Lincolnshire Company); to Scotland (conducted north of York by the North Eastern and North British) and to Leeds and Bradford (worked throughout by the Great Northern), are extremely excellent. Further particulars will be found in the following tables:

SERVICES TO TOWNS ON GREAT NORTHERN RAILWAY PROPER.

Between London and—	Distance.	No. of trains at or over 40 miles an hour.		Fastest.	
	Miles.	Down.	Up.	h.	m.
Cambridge	58	5	6	1	17
Peterborough	76¼	16	21	1	86
Grantham	105¼	20	23	1	57
Nottingham	127¾	11	6	2	32
Lincoln	130	5	2	3	45
Retford	136½	12	12	2	40
Doncaster	156	14	14	3	2
York	186	14	11	2	45
Wakefield	175	10	7	3	30
Leeds	185¼	8	6	3	50
Bradford	192	8	4	4	3

Services to towns reached by the Great Northern with aid of other companies:

From London to:	Reached over the lines of:	Distance, miles.	Best down train.		Best up train.	
			h.	m.	h.	m.
Newcastle	G. N. & N. E.	268¼	5	34	6	45
Sunderland	G. N. & N. E.	269	6	48	7	00
"	(via New Castle & Pelaw)	280¼	6	24	6	30
"	(via New Castle & Shield.)	286¾	6	50	..	..
Hull	G. N. & N. E.	205	5	00	4	35
"	do.	196¾	4	40	4	35
"	G. N. & M. S. & L. (to New Holland.)	179½	5	20	5	00
Halifax	G. N. & Lancs. & Yorks.	194¾	4	25	4	25
Burnley	do.	213¾	5	5	5	11
Accrington	do.	219¼	5	17	5	22
Rochdale	do.	213	4	40	4	58
Huddersfield	G. N., M. S. & L. & L & Y.	188½	4	4	4	15

It will be evident from an examination of the table that some very fast booked speeds between intermediate stations will be necessary in order to run some of the best trains recorded above. These fast booked speeds we find in great profusion. Fifty miles an hour is extremely common, and instances of 52, 53 and 54 miles an hour are very frequent. The best run on the system is that of an express from Peterborough to London (Finsbury Park) in 80 minutes (73¾ miles). There are also many expresses each way between London and Peterborough (76¼ miles) in from 86 to 90 minutes, and between London and Grantham (105¼ miles) in 117 to 130 minutes Taking the whole of this comparatively short system (under 800 miles) there are about 70 runs daily from one station to another at a booked rate of 50 miles an hour or over.

Actual Performances (with particulars of gradients).—We give below a few particulars of a run from daily practice, together with brief details of the gradients surmounted.

Stations.	Distance, miles.	Engine 544 and 12 coaches (144 tons). Time due.	Time actual.	Speed in miles per hour.	Particulars of gradients.
		p. m.	h. m. s.		
King's Cross		2 0	2 2 0		
Holloway	1½	.....	2 5 31	26	Ascends at 1 in 105
Finsbury Park	2½	.....	2 7 7	38	Ascends at 1 in 110 and level.
Harringay	3¼	.....	2 8 21	36	Easy ascent.
Hornsey	4	.....	2 9 10	56	Descends at 1 in 264.
Wood Green	5	.....	2 10 11	59	" " "
N'w S'uthg'te.	6½	.....	2 11 47	56	
Oakleigh P'rk.	8½	.....	2 14 26	45	
New Barnet	9¼	.....	2 15 28	44	Ascends at 1 in 200.
Hadley Wood	10¾	.....	2 17 22	47	
Potter's Bar	12¾	.....	2 20 20	39	
Hatfield	17¾	.....	2 25 31	59	Gradual descent.
Welwyn	22	.....	2 29 34	63	Descends about a mile at 1 in 200 and ascends 3 miles on same grade.
Knebworth	25	.....	2 32 51	55	Ascent at 1 in 200, followed by short easy descent.
Stevenage	28½	.....	2 36 13	62	Gradual descent.
Hitchin	32	.....	2 39 4	73	Descends at 1 in 200.
Th'ee Counti's	.....	.....	2 42 13	..	Descends at 1 in 200 and 264.
Arlesey	37	.....	2 43 26	69	Descends at 1 in 264 and 440.
Biggleswade	41	.....	2 47 11	64	Slight ascent followed by descent at 1 in 264.
Sandy	44	.....	2 50 1	63	Nearly level.
Tempsford	47½	.....	2 53 19	64	Nearly level.
St. Neot's	51¾	.....	2 58 3	54	Nearly level with slight rising tendency.
Offord	55¼	.....	3 2 35	53	Nearly level with slight rising tendency.
Huntingdon	58¾	...	3 5 49	56	Nearly level.
Abbott's Rip.	63½	.....	3 11 48	48	Rises most of the way at 1 in 200.
Holme	69¼	.....	3 17 0 (Lost 1 min. by slack.)	67	Falls most of the way at 1 in 200.
Peterboro	76¼	3 25 (To pass)	3 25 47 (Pass. at 5 m. an hr.)	.....	Level.

Good as the above performance undoubtedly is, it is inferior to many which have been made on the Great Northern on special occasions. London to Grantham (105¼ miles), has frequently been done in from 106 to 115 minutes, with a load of about 100 to 120 tons behind the

*For introductory article see *Railroad Gazette*, Aug. 12 page 590.

engine, and Grantham to York (82¾ miles) in from 85 to 90 minutes, with a similar load. With performances like these it is no wonder that the "single driver" engine is esteemed on this line.

Locomotives and Train Loads.—This company's locomotive engineer, Mr. Stirling, is a stout advocate of the "single driver" type. Of these he has two classes, dimensions of which are given below. The 8 ft. type was first built about 20 years ago, and has ever since done noteworthy work. The 7 ft. 6 in. type is of comparatively recent origin, but has also done well. A coupled type, frequently seen on the slower express trains, has 17½ × 26 cylinders and four coupled drivers 6 ft. 6 in. in diameter. None of the locomotives on the system have steam domes.

Dimensions.	8 ft. "single."	7 ft. 6 in. "single."
Cylinders, in.	18 by 28	18½ by 26
Heating surface, tubes, sq. ft.	936	1,001
" " box, sq. ft.	109	109
" " total, sq. ft.	1,045	1,110
Grate area, sq. ft.	17¾	18.4
Boiler pressure, lbs. per sq. in.	140	140
Weight in working order	45 tons 3 cwt.	39 tons 14 cwt.
Weight available for adhesion	17 tons.	17 tons.

Train loads on the Great Northern system are uniformly heavy and assistant engines are *never* employed, no matter how heavy or fast the train may be. We have frequently seen the 5:30 p. m. (allowed 123 minutes for the 105¼ miles to Grantham) pull out of King's Cross, London, with one 8 ft. single-driver engine and a load of about 200 tons (excluding engine). Punctuality all over the line is good.

The Manchester Ship Canal.

BY CHARLES HANSEL, C. E.

The progress of one generation often becomes the obstruction of the next; and I find no more striking example of this aphorism as applied to commerce than is illustrated in the evolution of methods of conveying between the cities of Liverpool and Manchester. Beginning with the King's highway, represented by coach and wagon, the river transport by the Irwell & Mersey Navigation monopoly, this in turn succeeded by the genius of Brindley and the courage of the Duke of Bridgewater in the building of the Bridgewater Canal, which was dwarfed by the iron highways of Stephenson, and which itself is now challenged by the gigantic ship canal, each in turn has obstructed and hindered to the extent of its powerful influence the progress of the others.

The Earl of Ellesmere has not less truly than elegantly said that "the history of Francis, Duke of Bridgewater, is engraved in intaglio on the face of the country he helped to civilize and enrich." His work was the first of its kind in the kingdom, and it was by the genius of Brindley that it was planned and executed, and it stands today after performing its work for five generations.

The general reader is no doubt informed concerning the work of the Manchester Ship Canal now being constructed. It may, however, be interesting to review the work of Brindley and Stephenson, in order that we may become familiar with the location and the growth of traffic between Liverpool, the principal port, and Manchester, the principal manufacturing city of England; and that we may appreciate the volume of business which has grown to overflow the present channels, and for the further reason that the present work on the ship canal is complicated in crossing the canals and railways now existing. The accompanying map shows the location of the first canal, the work now under construction, the principal stations and contiguous country,* and will serve to give a fair representation of the lines of transportation at present available.

In 1757 the united population of Manchester and Salford was only twenty thousand. The imperfect state of the roads and uncertain travel by river rendered it difficult at some seasons for so large a population to provide themselves with food, and the supply of coal was equally uncertain and expensive. There was no connection with the navigation of the Irwell and Mersey with any of the collieries situated to the eastward of Manchester. The same difficulty existed in transporting goods between Manchester and Liverpool.

Liverpool is the natural port of Manchester, and the wool, cotton and silk received at Liverpool for the looms of Manchester had to be transported by mules and pack horses or by the Irwell and Mersey navigation at the enormous cost of 40 shillings a ton.

This was the condition of things when the Duke of Bridgewater turned his attention to the building of a canal from Worsley to Manchester, which was the beginning of the enterprise that gave the city of Manchester its first certain communication with Liverpool, and was the first of England's navigable canals.

While it is interesting to examine this first great work of Brindley, I will not here consider more than the Barton aqueduct, which carries the canal over the Irwell with a clear head of 39 ft. for navigation on the Irwell. The bridge is made of three arches, the centre arch having a span of 63 ft., the total length of the aqueduct being 600 ft.†

MAP OF THE MANCHESTER SHIP CANAL AND OTHER WATER AND RAIL ROUTES.

The completion of the Duke of Bridgewater Canal to the tidal estuary of the Mersey at Runcorn was met by the opposition of the Irwell & Mersey Navigation Co., who saw their monopoly assailed, and every obstacle was placed in the way of the completion of the extension to Runcorn, but without avail. The locks were opened in January, 1773, establishing water communication between Manchester and Liverpool, a truly magnificent undertaking, nobly planned and skillfully executed. The total cost of this work from Worsley to Manchester, and from Longford Bridge to Runcorn was $1,100,000, which was furnished by the Duke. The business of this canal showed from the first the necessity for building it; and while its construction nearly involved the young Duke in financial ruin, it eventually reached an annual income of $400,000, and was in turn called a monopoly.

The business of Manchester increased so rapidly after the opening of this canal that it was found necessary to provide additional means of transportation to Liverpool. Cotton lay at Liverpool for weeks awaiting shipment, and it frequently required more time to transport the cargoes from Liverpool to Manchester than from the United States to Liverpool. The canal was overcrowded with business, and the Duke's agents, believing their position impregnable, gave but little care to the forwarding of freight so as to best accommodate the business which of necessity must be given them. "The Duke's Folly," "Brindley's Castle in the Air," humble though it now appears, was the parent of the magnificent works of Rennie, Telford, Stephenson and Brunel.

The charge for carriage by water had been lowered by the canal to about five shillings per ton between Manchester and Liverpool. The poor decayed town of Liverpool of Queen Elizabeth's time had now become the principal seaport of the kingdom. Chester, its early rival, being left dry upon the sands of Dee by the silting up of the river channel, ceased to build and send its vessels to our shores, and instead of being a busy port pushing forward to continued prominence in the commercial world, it sinks back upon the ruins of its Roman walls and water towers, ringing the curfew to remind all of its retrogradation. When the Duke commenced the construction of his canal he had to contend with the fierce opposition of the Irwell & Mersey Navigation, and now we find the agents of the Duke assuming the prejudice of the people. This opposition and prejudice was multiplied many times when Stephenson proposed to carry persons at the astonishing speed of 12 miles per hour by using the locomotive, and in contradiction to the best judgment of the foremost engineers of the time. He stood alone without the monument of previous success to support him, and by his genius and perseverance planned, constructed and organized the system which has expanded to 370,179 miles, bringing the people and the nations of the world together.

The first train from Liverpool to Manchester, on Sept. 15, 1830, carried the Duke of Wellington, Sir Robert Peel and other distinguished persons in the allotted time of two hours, the distance being 31 miles. To-day through express trains run the distance in 45 minutes at intervals of 15 minutes, and yet it is found that 14 tracks are not sufficient to accommodate the immense traffic and additional means are being provided.

The work of constructing the ship canal is the result of the action of the business enterprise of the two cities in connection with the Parliamentary committees in 1885. The conditions surrounding the traffic between these busy and growing cities evidenced the need of securing to Manchester the facilities of a port, enabling it to receive the raw material for its mills in bulk. As every advancement in methods is met by the opposition of some interest which is likely to be injuriously affected by its promotion, we must look for the points which are likely to be so affected.

The Corporation and Dock Board of Liverpool have constructed the finest docks in the world from the tolls levied upon vessels touching at that port. This corporation sees in the successful completion of the ship canal a diminution in revenues from tolls. The interests of the railroads connecting these cities will likely be affected in the same ratio, and it is not surprising to find these two gigantic interests joined together to oppose the building of this rival, and so strong and fierce was this opposition that it cost the promoters three-quarters of a million of dollars in obtaining the act which enabled them to commence this work. The first scheme was to construct a ship canal from Manchester to Runcorn, and from thence to Liverpool down the channel of the tidal estuary of the Mersey, the channel in the Mersey to be maintained by training walls. The opponents of the bill found in this plan an opportunity to make a strong case against the whole scheme, claiming that this work would ultimately destroy the Mersey by forming an accretion, as in the case of the Dee. The final plan adopted was to commence the canal at Eastham, six miles above Liverpool, on the southern

* I am indebted to Mr. C. Leader Williams, M. Inst. C. E., Chief Engineer Ship Canal Co., for this map as well as the further information concerning the plans and present status of the work.

† Further mention will be made of this aqueduct in connection with the Ship Canal.

shore of the Mersey. For a distance of 21 miles from Eastham to Latchford the canal will be fed by the tide.

The total rise in level of canal is 60 ft. 6 in., which is made by five sets of locks as follows:

Eastham (Tidal).

No. 1, 600 × 80 ft.
No. 2, 350 × 50 ft. } Rise from mean tide to ordin'y level, 9 ft. 6 in.
No. 3, 150 × 30 ft.

Latchford.		Islam.	
No. 1, 600 × 65 ft.	Rise	No. 1, 600 × 65 ft.	Rise
No. 2, 350 × 45 ft.	16 ft. 6 in	No. 2, 350 × 45 ft.	16 ft.
Barton.		**Mode Wheel.**	
No. 1, 600 × 65 ft.	Rise	No. 1, 600 × 65 ft.	Rise
No. 2, 350 × 45 ft.	15 ft.	No. 2, 350 × 45 ft.	13 ft.

The lock gates are constructed of green heart imported from Demerara, which is an exceedingly durable wood, and well suited to this work. The locks are provided with sluice gates on Stoney's patent, working on a frame of rollers so balanced by water ballast as to be easily raised or lowered. The dock and lock walls are made of concrete wherever practicable. The copings and hollow quoins are of Cornish granite. The walls are built with vertical lines, the granite work generally commencing at the water level. From Latchford to Manchester, 14 ¼ miles, the canal will be supplied by the waters of the Mersey, Irwell and other rivers, making a canalized river.

The general dimensions of the canal are: Length, 35½ miles; minimum width, 120 ft. at bottom; average width at water line, 172 ft. From Barton (Duke of Bridgewater Canal) to Manchester the canal will be 170 ft. wide on bottom and 220 ft. wide at water level. The minimum depth of the canal is 26 ft., the lock sills being 28 ft. below water level to allow for deepening canal. The embankments constructed on flats are 30 ft. wide on top, with outside or river slopes of 1½ to 1 and inside or canal slope of 1 to 1. Dock areas at Manchester will have a water surface of 114 acres, the quay space 152 acres. At Warrington the dock will have an area of 23 acres. Besides these docks there will be a large water surface available at Frodsham, formed by backing up the river Weaver for a distance of three miles from the canal. The first 21 miles of the canal will be operated a portion of the time with open gates, the level of the water in the tidal portion being 14 ft. 2 in. above mean high water in the Mersey. At spring tide the water will rise from 5 to 7 ft. above the ordinary level of the canal, which will allow of the gates being left open during that tide.

The aqueduct over the Irwell, the highest product of Brindley's work in the construction of the Bridgewater canal, is soon to be effaced, and its office filled by the work of the engineer of to-day. The Ship Canal now owns the Bridgewater Canal, and for the passage of vessels with fixed masts it is necessary to provide more headway than is furnished by Brindley's arched aqueduct, and the method of providing for the carrying of the Bridgewater Canal over the Ship Canal bears testimony to the high skill attained by the bridge builder of to-day. The water of the Bridgewater Canal is carried over the Ship Canal by a movable aqueduct which will enable vessels to pass on the Ship Canal with fixed masts. This aqueduct is similar to what is known as a draw or swing bridge, pivoted on a central pier with a clear water-way on each side of pier of 90 ft. The aqueduct, or swing bridge, is of iron walled up a sufficient height to contain the water of the canal. When a vessel with fixed masts passes on the Ship Canal the aqueduct is closed at each end, as is also the Bridgewater Canal, and the aqueduct with its burden of water is swung or opened for the passage of the vessel on the Ship Canal. All highways and railroads crossing the Ship Canal are carried by high level or swing bridges. The minimum clear headway between water level and bridge is 75 ft. Between Runcorn and Barton there are two high level and six swing bridges.

The quantities of materials moved and of the work built is calculated by millions, there being 70,000,000 brick needed, 1,250,000 cu. yds. of sand for concrete, 220,000 cu. yds. of masonry, 36,000,000 cu. yds. of earth excavation, 10,000,000 cu. yds. of sandstone excavation.

One hundred steam excavators, 173 locomotives, 6,300 cars, 194 steam cranes, 182 portable and other steam engines have been employed in this work. The English excavators have in favorable ground moved 2,000 cu. yds. per day, the average work being 700 cu. yds. per day.

The slopes of the cuttings vary from 1 to 1 to 2 to 1, and from such examination as I was able to make, between Manchester and Barton and Eastham and Ellesmere Port, I found the slope too steep for the soil, and although an effort had been made to protect the slope by facing with stone, it has not proved successful, and in my opinion much trouble and great expense will be incurred in carrying out these slopes to the proper line.

The canal is now completed and in use by the company's vessels from Eastham to Ellesmere Port, four miles, at which port extensive work is necessary to provide for the Ellesmere Canal. Work is being pushed along the entire length of the canal, most of the masonry being finished, and the great work is well on, but will probably require 18 months to complete.

The work has met with the usual adverse and retarding influences attendant upon all great enterprises, and the original estimate of cost has been exceeded in construction, and possibly the undertaking would have been greatly delayed for want of funds but for the assistance of the city of Manchester. The original estimate amounted to some $35,000,000, which sum was expended some 12 months since, and an additional sum of $15,000,000 was called for to insure the completion of the work. Canal shares were not being taken in the money centres of the world. The success of the Suez Canal was shadowed by the failure of the Panama scheme, and it seemed impossible to enlist additional aid in the face of the opposition of those whose interests caused them to lessen the value of the enterprise.

The city of Manchester having the greatest interest in the successful completion of the canal, its merchants favored the advancement by the city of the money necessary to complete the work. Before this loan could be made by the corporation it was necessary to secure an act of Parliament, which was accomplished. The original shareholders consented to accept a second lien, surrendering the first lien to the Corporation of Manchester. As the corporation can borrow at 3½ per cent., and as the shares bear 4 per cent. this is a satisfactory arrangement for the city.

The canal is to be lighted with electric lights, enabling navigation to proceed by night, and it is estimated that the canal will be traversed in 10 hours.

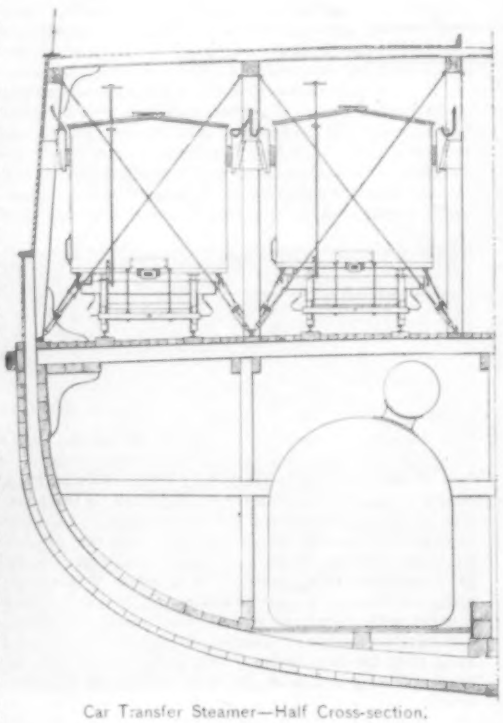
The spoil from excavation has been deposited in the former river channel and other depressions near the canal, forming valuable dockage and sites for new industries. New lines of railway are being extended to favorable points along the canal to compete for the new business which they foresee. The coal and salt fields of Lancashire and Cheshire are reached by the canal. The chemical works of St. Helens, Widnes and Runcorn, and the coal, iron and pottery trades of Staffordshire are connected with it by rail and waterways. These industries, together with the great manufacturing districts of Lancashire and Yorkshire promise a business sufficient to warrant the expenditure necessary for this great work, dealing as it does with the largest population and trade ever established in a similar area.

The Car Transfer Steamer Ann Arbor.

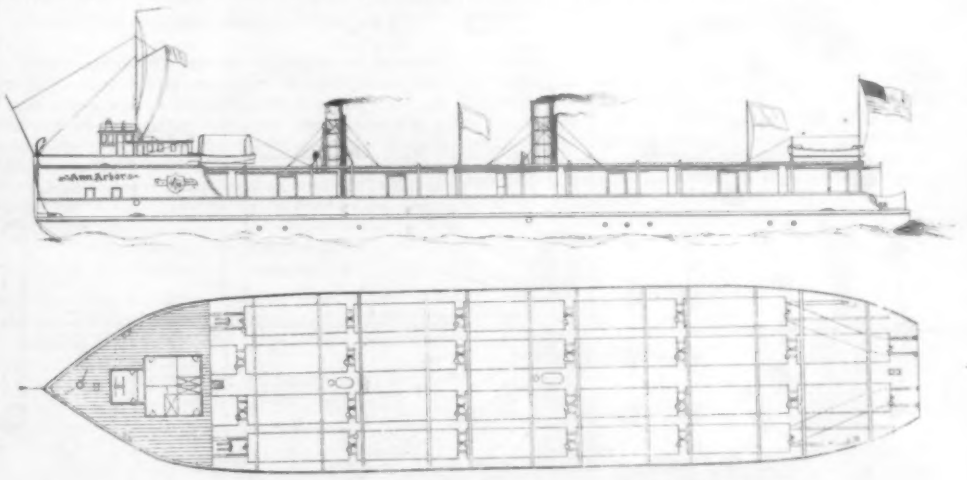
The Toledo, Ann Arbor & North Michigan, which has for some time been perfecting its arrangements for a through freight line from the West to the East, has now building two large steamers for Lake Michigan, described below. This freight line is to be kept running through summer and winter. Its main western terminus is at Winona, Minn., the end of the Green Bay, Winona & St. Paul railroad, this company and the Toledo, Ann Arbor & North Michigan being the principal members. The eastern connections are the Grand Trunk and the Delaware, Lackawanna & Western, with which the western lines have traffic contracts. The Green Bay, Winona & St. Paul has a connection at Merrillan, Wis., where it can receive St. Paul and Minneapolis traffic from the Chicago, St. Paul, Minneapolis & Omaha. The distance thence to Green Bay is 148 miles. Thence the route is over the Kewaunee, Green Bay & Western, a leased line, to Kewaunee, 34 miles. From here freight is taken across Lake Michigan to Frankfort, 60 miles, and the Toledo, Ann Arbor & North Michigan carries it across Michigan to Durand, whence it is taken eastward by the Grand Trunk and the Delaware, Lackawanna & Western. This route is operated by companies in very close relations with each other, and for traffic purposes it is practically one line.

For the greater economy of operating the route, the Toledo, Ann Arbor & North Michigan is having built at the yards of the Craig Ship Building Co. at Toledo two transfer boats capable of carrying 24 freight cars each. One of these will be launched by Sept. 15 and will go into service about Oct. 1; the other will follow some six weeks later. The first, the "Ann Arbor," is illustrated in the engravings. The car transport service of 60 miles at this point is attended with all the difficulties found in taking cars across the mouth of the Chesapeake Bay and some difficulties peculiar to the situation. There are deep water and heavy seas, and in winter heavy running ice; consequently it was necessary to make the transfer boat with high and strong bows. The cars are loaded at the stern and the bow is decked for a distance of 50 ft. back and rises 25 ft. above the load line. The vessel is 267 ft. long on deck, 52 ft. beam and 18 ft. molded depth. It is calculated to draw 12 ft. of water and to have a displacement of 2,550 tons at that draft.

The vessel is built of oak with a solid frame up to 2 ft. above the loading line and will have a belt of iron 6 ft. wide to protect the planking from the ice. Extra deck beams are placed at the load line to prevent crushing in if the vessel is nipped in the heavy ice. She is strengthened longitudinally by a steel cord with diagonal steel ties every 4 ft. running to the keel. The keelson is strengthened with a steel plate 2 ft. wide and three-quarters of an inch thick. The vessel is so modeled as to ride over and crush down ice rather than cut it through.



Car Transfer Steamer—Half Cross-section.



Car Transfer Steamer of the Toledo, Ann Arbor & North Michigan Railroad.

Built by the CRAIG SHIP BUILDING COMPANY, *Toledo, Ohio.*

There are twin screws in the stern and a single screw in the bow, which are worked by three horizontal compound condensing engines of 20 and 40 in. diameter, and 36-in. stroke. There are three boilers 10 ft. in diameter and 14 ft. long calculated for 125 lbs. of steam pressure. The vessel will be equipped with the latest appliances, such as steam steering gear, steam windlasses, electric lighting and an electric search light to insure safety in night navigation.

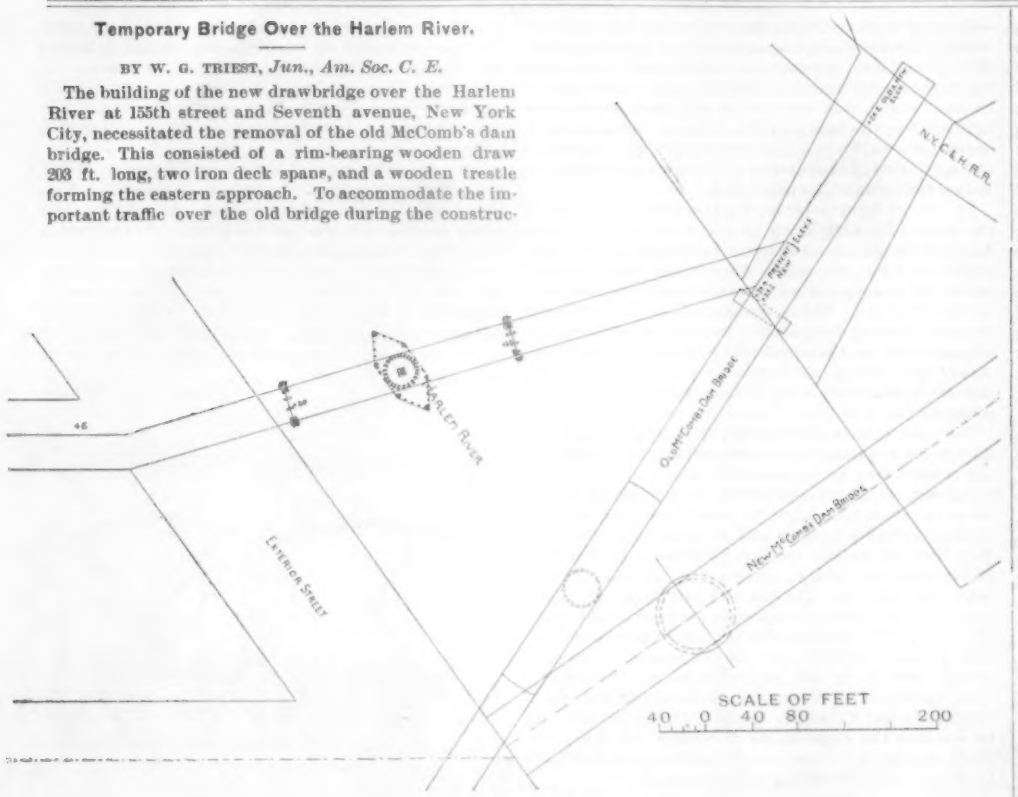
The cars will be secured by a method different from any heretofore practiced. There are four tracks, and there will be two posts on each side of each car between which posts the cars will be wedged by keys, as shown in the cross section. These posts are connected longitudinally by heavy stringers, and diagonal tie rods will be put in place between each two cars. These tie rods will be provided with turnbuckles to properly adjust their length. By this arrangement any damage at any part of the structure will be largely localized. The cars will be held to the deck by four chains attached to the trucks, each with a turn-buckle. These attachments are also shown in the cross section.

The vessel is expected to make a mean speed of ten miles an hour.

Temporary Bridge Over the Harlem River.

BY W. G. TRIEST, *Jun., Am. Soc. C. E.*

The building of the new drawbridge over the Harlem River at 155th street and Seventh avenue, New York City, necessitated the removal of the old McComb's dam bridge. This consisted of a rim-bearing wooden draw 203 ft. long, two iron deck spans, and a wooden trestle forming the eastern approach. To accommodate the important traffic over the old bridge during the construction of the new draw, a temporary bridge is being built nearly on the line of 156th street, as shown on the plan.



Location of Temporary Drawbridge.

Harlem River and 156th Street, New York City.

It consists of a trestle along 156th street, of a draw span and of a trestle, which connects with the eastern approach of the old bridge. This approach had a steep grade and had to be lowered to a level. The trestle along 156th street is built of sill bents, 14 ft. between centres, with a grade of 4¾ per cent., and the trestle east of the draw is composed of pile bents of four piles each, 16 ft. between centres, with a 2 per cent. upward grade. They give a roadway of 23 ft. and one sidewalk of 6 ft.

The construction of the temporary draw-pier and its fenders is shown on the engraving, a reproduction of the contract drawing. The pier has a centre cluster of 16 piles, surrounded by 24 radial pile bents of two piles each, sprung together at the top in order to give a batter. The caps run to the platform of the centre cluster, and the whole pier is well braced in every direction.

The draw of the old McComb's dam bridge is used again as the draw-span of the temporary bridge and has been bodily transferred to its new site and lowered to the elevation of 20 ft. above mean high water against its old elevation of 34½ ft. The accompanying cuts from photographs show the removal of the draw, which was successfully effected within 1½ hours. Square cribs of strong timbers, solidly braced fore and aft, were built on two barges which were floated under the draw, one at each side of the pivot pier and were secured together at the bow. When the rise of the tide had lifted the bridge off the wheels the barges were towed clear of the pier, the sterns braced apart and the bridge was towed over a third crib, built on piles a few hundred feet above the temporary bridge. The draw came to a bearing on this intermediate crib at ebb tide, and enough layers were taken off the cribs on the barges to just lift the bridge off the centre crib at the next flood tide. Then the height of this crib was reduced so as to carry the bridge at the following ebb tide. This process was repeated until the draw had been lowered the desired 14½ ft. The new pivot pier had been completed in the meantime, and to it the draw was floated on its two barges.

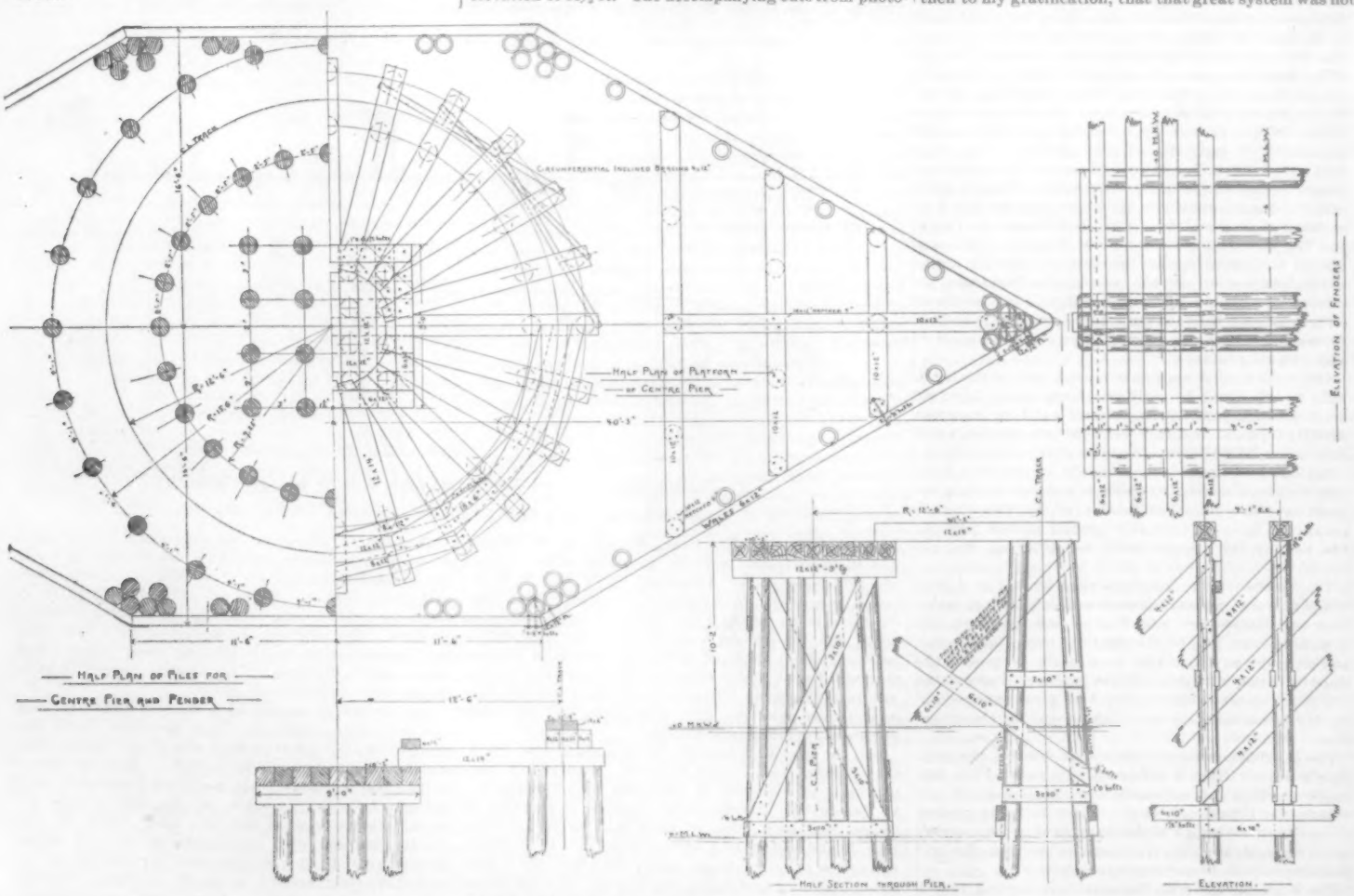
This temporary bridge is being built according to the designs and specifications and under the supervision of Mr. Alfred P. Boller, who is the engineer of the new permanent drawbridge. The contract for the bridge, for a part of which the timber of an existing trestle was available, was let to T. & A. Walsh, New York City, at a lump sum of $12,000. The work, which was begun July 13, is being rapidly and well done, and will be finished next week.

One of the Needs of Stevens Institute.

At the recent meeting of the Alumni Association of Stevens Institute Mr. E. B. Wall, President of the Association, delivered an address, some extracts from which follow:

When I was notified of the results of your last election I was told that the duty of the President was to preside at the annual meeting and deliver an address. I thereupon thought over the subjects that concern the course of instruction at the Institute, which, by our experience in the world, we think could be amended or improved. There probably was never an alumnus who did not think he could improve upon the college curriculum, and the younger the alumnus the greater the improvements he thought he could make. Do not let me discourage any of our new members by this statement. If you have a plan for improvements and the time is not ripe, write it out on paper and file it away ready for use. Generally you will find that when the opportune moment for its presentation arrives you can improve upon it wonderfully. If we would thus make written comparisons of our views year upon year, we should be amazed at the lack of consistency in that thing we call the march of civilization.

I put down a plan for improvement in this way sixteen years ago to-night. it was in my thesis. The subject was "The Principles of Car Framing." When I entered the service of the Pennsylvania Railroad immediately after graduation I discovered, first to my horror, and then to my gratification, that that great system was not


HALF PLAN OF PLATFORM OF CENTRE PIER
HALF PLAN OF PILES FOR CENTRE PIER AND FENDER
ELEVATION OF FENDERS
HALF SECTION THROUGH PIER.
ELEVATION.

PILE SUPPORTS FOR TEMPORARY DRAWBRIDGE.

Harlem River and 156th Street, New York City.

ALFRED P. BOLLER, *Engineer.*

using a freight car frame in accordance with the principles deduced in my thesis, and that it was, consequently, scientifically deficient. I was gratified to think that I was to be afforded an opportunity to be of value to my company by correcting the greatmistake. I therefore inaugurated a campaign in favor of my thesis. I found many who would listen and apparently agree with my scientific demonstration, but none would take action. Finally, after keeping the subject in view for five years, I was detailed to design a new stock car that would be superior to any of the cattle cars in use. I traveled all over the country examining the cars of our competitors, that being one of the first steps in the developmeut of all railway improvements, and then studied the requirements of the traffic at the stock yards and on the road.

In my plan for the car and the arguments I wrote for its adoption, I found the opportunity for the car frame of my thesis. In it went; and while some doubts were expressed by the superior officers on the frame, the car itself was considered so good that it carried the frame with it. A thousand cars were built, and in one year the results of service had proved that the side frame which I ha l cherished so fondly was no good—that, with all my figures, it had developed an irresistible tendency to drop down in the middle and cock up at the ends. Happily for me the other features of the car had proved valuable, it being the first of the 34-ft. long bodies which has since become the standard length for a number of railroads, and as the remedy for the deficiency in the bracing was apparent and immediately applied, I was not confounded.

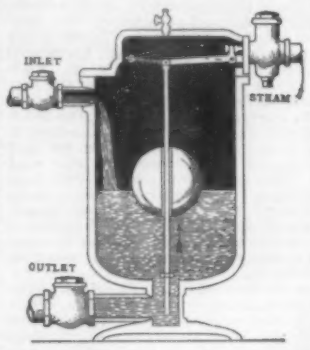
With this in mind when I approached the subject of improvements in the college curriculum, I was affected with a modesty that was not born of the intrepid days of '76, when all the world seemed to need revision, and the men of our '76 felt as brave to tackle the earth as those of 1776 had been to tackle the Britishers. I came to the conclusion that I did not know very much about the college curriculum as it now stands, and that I had better take up some of those outside subjects upon which the students in no school, so far as I know, are instructed; subjects that our experience indicates are of importance to them.

For illustration, let us consider the subject of organization. Engineers bred here may be divided into two classes: Those who become engineers *per se*, either as consulting engineers, professors, or the mechanical engineers of large corporations or great works. Second, those who become operating officers of important industries where the duties require the application of engineering knowledge to executive work. The latter class does not generally include discoverers or investigators in the abstract. The men in this class follow, so far as their engineering work goes, in the footsteps of the mechanical engineer *per se*, and apply his discoveries to the needs of business. A large number of the Stevens men are employed in the work of the last class, and many are likely to follow. As it is essential that in doing this kind of work the engineer must act through an organization, it would appear advantageous that students in the senior year be given a few lectures on the organization, covering in general the plan, upon which the mechanical departments of our railroads are operated; the organization of large workshops, factories and shipyards, and the possibilities of temporary organizations in emergencies, as in the rebuilding of a railway under circumstances like those prevailing at the time of the Johnstown flood.

I prepared some notes on these points as arguments for instructing the students on organization, but the more I thought on the matter the more apparent it became that it was not organization in the abstract that was desired at the present time, but organization in the concrete, not for the students, but for ourselves—organization for the purpose of raising funds for Stevens. We have a right to be proud of the record of the Alumni Association, for, with a membership of 400 men, the majority of whom have been out of college only five years, we have raised $17,000 for the extensions that are so essential to the prosperity of our college. We have $33,000 yet to raise. There are many philanthropic men in our land, who, if they knew the benefits to be derived by future engineers from the accomplishment of our plans, would come to our aid We must organize to reach such men. As a step to this end I would advise the appointment of a committee to prepare articles on the Institute, its object, its success, and its requirements for the future, together with a review of the work done by the Alumni Association for publication in the technical journals. It is usually accepted that an Alumni Association should have age before it can influence and benefit its Alma Mater; that the alumnus may first do a little unto himself before he commences to do unto others; but here we are 15 years old to-night—still in our teens—planning and working for Stevens. We cannot meet here to indulge in the pleasure of reminiscences, like the alumni of classical colleges. We are so young, and there is so much to do that we have not time to live in the past—the needs of the future are upon us. This is not a time for retrospectives. We have to do with prospectives. And, therefore, thanking you for your kind attention, I make way for the business of the hour.

Van Auken Automatic Boiler Feeder.

A simple automatic boiler feeder is shown in the engraving. It has no outside working parts. The float and equalizing valve are attached to the cover, making it convenient for inspection. The feeding pulsation of this feeder takes place only when it is entirely filled with water, and when entirely emptied. The operation is as follows: After the feeder is placed in position the drips from all heaters are run into a receiver and the condensation is forced up into the feeder by the pressure in the heaters. After the feeder has become filled, the equalizing valve that is connected with the steam dome is automatically opened by the float shown and the pressure is equalized to that in the boiler, and the water then flows through the lower pipe into the boiler by gravity. When emptied the equalizing valve is automatically closed by the float and the steam that remains in the feeder is condensed and the feeder again fills and the operation is repeated. Swinging check valves are placed in the inlet and outlet connections and valves are provided to prevent back pressure from the boiler entering the feeder, and also to prevent the pressure in the feeder entering the drip pipes.



These feeders are manufactured in sizes to drain from 1,000 to 15,000 ft. of 1-inch pipe, by The Van Auken Steam Specialty Co., Chicago, Ill.

A New Variable Exhaust Nozzle.

The Macallan & Adams variable exhaust nozzle, of which two forms are shown in illustration, is based upon the idea that fine adjustments of the nozzle area are unnecessary, and that two or three sizes of exhaust tips are sufficient for practical purposes. In the design shown by figs. 1 and 2, two sizes are provided. When the parts are in the positions shown by fig. 1, the nozzle area is that of the small end of the conical ring *A*, but when this ring is thrown back as in Fig. 2 by means of the lever connection *C D*, *D E*, the tip is formed by the narrow ring *G* fixed in the end of the exhaust pipe.

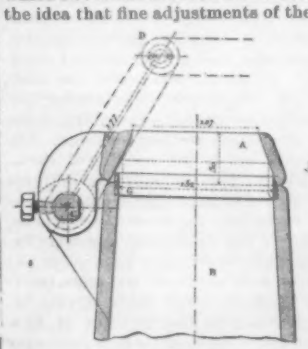


Fig. 1.

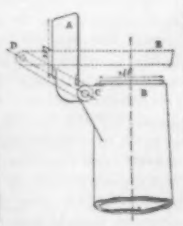


Fig. 2.

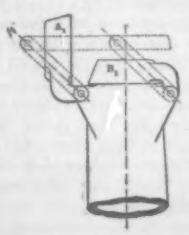


Fig. 3.

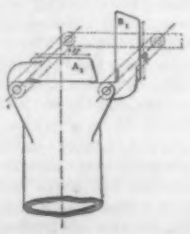


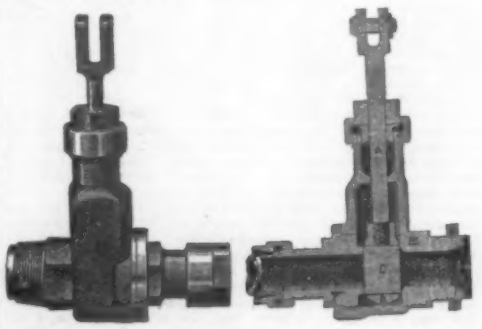
Fig. 4.

In the pattern shown by figs. 3 and 4, a second conical ring B_1, is mounted opposite the first, making three sizes possible. In still another form, the rings A_1 and B_1 are operated by means of a central spur gear and two pinions. According to the *Portefeuille Economique des Machines*, this type of nozzle is now being tried upon the Great Eastern and the London & Southwestern railways, in England.

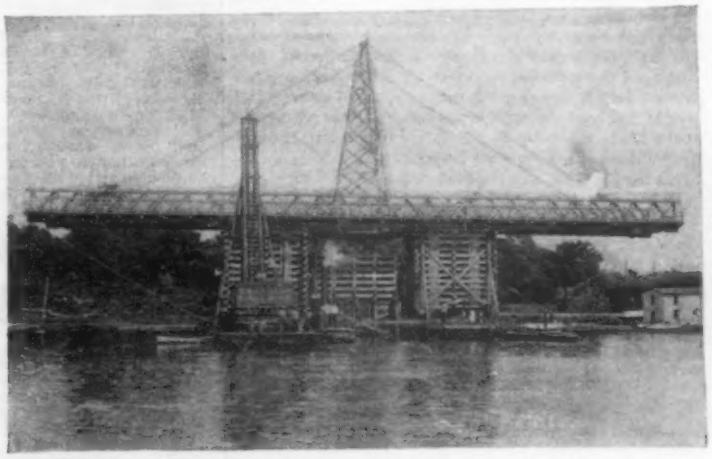
The Johnstone Blow-Off Valve.

The Johnstone blow-off valve, as shown in the engravings, is the standard of the Mexican Central Railway. Three of these valves are placed on each engine, one on each side of the firebox just above the mud ring and toward the front, and one beneath the boiler in the forward ring. Suitable overflow pipes are provided to carry the water and grit away from the working parts. The valves are operated from the cab by lever and rod connections. One valve is worked from the engineer's side and two from the fireman's side of the cab.

The blow-off has a gate valve, *C*, of cast iron fitted to and sliding upon the cast iron seat *D*. The valve yoke *B* and the bushing *F* are also of cast iron. The valve stem *A* is of wrought iron. The body casting *E* is made of brass. A screw-thread is cut upon the extension of the body *E*, which is also provided with a hexagon. This extension is screwed directly into the boiler sheets. In operating, any scale or mud lodging on or against the valve seat is removed by the valve when returning to the closed position. Unlike the usual plug valve, mud and scale does not prevent the closing of the valve, and, being a gate valve, when full open there is no restriction of the passage-ways, as they are of the same diameter throughout.



The practice of the Mexican Central is to open all the valves, when steam has been shut off and the sediment has had reasonable time to settle. The blowing off usually occurs on level track or when going down grade. This valve is the invention of Mr. F. W. Johnstone, Superintendent of Motive Power, and is manufactured and sold by the Crosby Steam Gauge & Valve Company, Boston, Mass.



TRANSFERRING DRAWBRIDGE FROM OLD TO NEW PIER.

Harlem River and 150th Street, New York City.

Foreign Railroad Notes.

A bill has been introduced into the German Confederate Council establishing the time of the fifteenth meridian east of Greenwich as the legal standard for all purposes. An elaborate statement of the argument in favor of the change is presented with the bill.

Mr. Frans Ulrich, the tariff expert in the Prussian Ministry of Public Works, read a paper before the Railroad Society of Berlin last May giving an account of the shocking condition of railroad affairs in this country, as shown by Mr. Albert Stickney, in his book "The Railway Problem."

With a good deal of reluctance the Berlin street railroad companies have taken the preliminary steps toward supplanting horse by electric traction on their lines, the matter having been vigorously pushed by the city council. An experimental section is shortly to be operated on the storage battery system.

Automatic vending machines are now used in Berlin, Germany, for the sale of railroad tickets for the metropolitan belt line. The machines hold a thousand tickets and are capable of delivering them at the rate of 43 per minute. They are said to have thus far given entire satisfaction.

The new fast passenger trains between Berlin and Cologne, Germany, are evidently designed to carry out the vestibule notion so popular with the American traveler. The description given of them in one of the German papers, in any event, explains that the cars are all fitted up luxuriously and are connected with one another in such a way that a passenger may comfortably walk the entire length of the train. One car in each train is, moreover, provided with a buffet from which both warm and cold food can be supplied to the passengers. The seats are numbered and special tickets must be bought for them, the extra charge being one mark.

A Mechanical Record of Car Movement.

At the last meeting of the Car Accountants' Association Mr. C. E. Wheeler, of the Lake Shore & Michigan Southern, gave an interesting account of an experimental system, tried in his office, of keeping the record of Lake Shore cars, both those on his own road and those away from home, by means of numbered blocks of wood. The main features of the plan will be recalled by those who read the report of the meeting in the *Railroad Gazette* of July 1, but as the details are also of interest we give Mr. Wheeler's paper nearly in full, the Secretary of the Association having finally given it out, through the columns of his monthly journal.*

The card system was the first approach to the graphic idea, and the warm commendations of its friends prove the insufficiency of the old system, its defects being:

1. The work and its results are too much scattered; the ability to draw information from a large number of record books, classify and use it quickly is incommensurate with the demands of to-day.

2. The method itself is out of all harmony with present railroad science. The President is no longer content with a general view of affairs and to scan the fiscal reports at the end of the year. He is more and more taking a hand in details, and no small help to any department officer is his ability to anticipate information or at least have his office work so systematized that when wanted the information may not be delayed unreasonably. Our aim should be to devise some record which will bring the information out of hiding, not from a dozen sources twice a month when a location statement is to be made, but 30 days in the month and every hour in the day.

3. Another objection to the book record is the stationery waste. Not one-fifth the space of an ordinary book is used, the rest is waste.

4. The monthly or bi-monthly transfers are lost motion. They cannot be called a necessity for bringing to light cars long absent from the home road, though useful in that respect.

The chief objection is the inaccessible condition of the information the books contain; the dependency upon so many clerks for that information, and thus a proportionate increase in the chances for error; the length of time required to make the information available, and the stopping of the record work while gathering it.

The card system enables one, by a glance at the case or pigeon holes, to measure, to a degree, accurately, the number of cars on any particular road. It has been refined upon by differentiating the equipment with cards of colors, say white for box cars, red for flat cars, etc. This system contemplates a separate pigeon hole for each road with whom the interchange of cars is large enough to justify the space. An independent force of from one to four clerks is maintained to keep an interchange record on the cars, the home movements being ignored. Each card represents one car, and as that car moves to various roads, its movement from one line to another is followed by the moving of its card in order to the pigeon holes allotted to the respective roads. Two serious objections rest against it; one, its expense for doing duplicate work, for the record proper still shows like information; and the other is its inability to be manipulated with any degree of speed any more than the ledger where missing movements are encountered. At such times recourse must be had to the records. In other words, it is duplicate work at considerable expense and not independent. Where, too, as with our line, 1,600 cars at a time are to be found on one of our connections, the handling of the cards must be cumbersome and productive of much lost motion.

Neither the ledger nor card plan can be entirely relied upon. Cars frequently return from connections and the movement is not recorded by the junction agent. Either the record clerk, after the first movement on the home road, must notify the card clerk, or the car remains charged to the connection.

The system introduced on the Lake Shore & Michigan Southern is a combination of the record and card idea. Imagine a small block eight inches long, one inch wide and one-quarter inch thick. Upon one of the ends the car number is painted in such a color as to show the kind of car; A black background and white figures, a furniture car; white background and black figures common box; red background and white figures, certain specialty cars; white background and red figures, wagon cars; and so on, distinguishing equipments by color. If now, upon the surface of the block provision is made to slip into it a piece of paper, we have in effect a miniature car, which, as it moves from road to road and upon the home road, can bear its own record. When the paper slip is filled it is removed and filed away, another being placed in the block, or the slip can be removed monthly and the mileage computed.

The cases in which the blocks are kept are divided into two divisions, one for movements on the home road; the other for movements on foreign lines. The portion assigned to home records is, say, two feet high, two feet wide and eight inches deep. It is divided ten times horizontally and ten times perpendicularly by partitions, thus yielding 100 pigeon holes and permitting the location of all cars by the last two figures, car 22,869 going into the tenth perpendicular and the seventh horizontal compartment, and so with all cars ending in 69. Each case, which is from two to three feet high by six feet long, will provide for from 2,500 to 3,000 cars—one clerk's work. While now the car is on the home road, the block will remain in its proper pigeon hole; when it leaves it is removed precisely as the card system calls for, and the block goes to a pigeon hole assigned to the road now having the car. This pigeon hole is divided once horizontally and ten times vertically, thus again permitting the location of the car, this time by the last figure. Cars above the horizontal division are those 15 days and over on the line; those below, less than 15 days. It takes 15 minutes each day to make the transfer from below to above of cars going over the 15 day limit.

We began the use of this plan in the midst of the recent heavy freight movement, on 2,500 box cars, which included all our furniture cars, which move from Mexico to Nova Scotia. It is the hardest lot of cars to have to keep track of, since there are no limitations whatever as to points to which they may not be loaded by the Grand Rapids furniture companies and other large industries on our road. The first day the record was completed by 5 o'clock p. m.; the second by 4 o'clock; the third by 3 o'clock, and one day at 11:15 a. m., the record clerk in charge reported for other work. It has uniformly kept ahead of the books. Three clerks have tried it and all with uniform success. Missing movements are not a source of trouble; any block can readily be found in from 5 to 20 seconds, without any previous knowledge as to its location. We have found by the use of this system—

1. That at all times we know where the cars are. The eye takes in the situation quickly at a glance, and at the same time notes the kind of cars.

2. It furnishes a sure check on delayed cars on our line. The block of the car whose movement is last recorded goes on top in its pigeon hole, and thus the blocks of the delayed cars gravitate to the bottom.

3. It is fully as fast as books, if not faster. We have found it more rapid.

4. It enables one to better distribute labor economically. In the winter, for example, when flat cars are idle and other cars busy, the spare time of a record clerk can be utilized, since two can work at the case without conflict, one on the home movements, the other on the junction cards.

5. We can furnish a location statement of all our equipment fifteen days and over and less, and show the various kinds of cars, in forty-five minutes.

6. It does away with all labor now employed on ledgers and cards, since the ordinary record force is sufficient.

7. It enables tracing to be done without interfering with the work of the record clerk. The list for tracing is constantly confronting one.

8. As the entire record is kept on the block, a missing receival of a car from a connection plays no part in the manipulation of the block. It would go to the home case after the first movement of the car on the line. It thus avoids errors of the cards or ledger.

9. After the first cost of case and blocks it is fully as cheap as books.

10. Transfers are distributed equitably and not made at the end of a month or two months; consequently, the record does not drop behind.

11. It enables higher officials by a personal visit to gain at any time a perfect idea of car location. It has been so used in our office repeatedly.

I may conclude in saying that a determined effort not to fool ourselves has resulted in a thorough conviction that we have a car record in this kindergarten plan that is free from any flaw deserving mention, and does all and more than we anticipated when first starting as an experiment what quickly proved itself a success.

In the following discussion Mr. Wheeler said that missing movements caused no trouble whatever. The slips removed from the blocks after being filled up can be filed in very compact shape, and a ten years' or twenty years' record of any car can be transcribed in one-sixth the time necessary to get it from book.

Improvements on the Illinois Central.

The Board of Directors of the Illinois Central has issued a circular to the stockholders proposing an issue of $5,000,000 of new stock to cover the present and proposed improvements for the road at Chicago and other points. The increase, $5,000,000, will make the total capital stock $50,000,000. The directors recommend that stockholders be given the privilege of subscribing to the new stock at par in proportion to their holdings. The proposition will be voted on at the meeting of stockholders called for Oct. 12. The probable expenditures are estimated as follows: For passenger depot and general offices, Chicago, $1,000,000; for elevation of tracks, Jackson Park, $1,000,000; for equipment and other expenses in connection with the World's Fair, about $1,000,000; for erection of new shops at Burnside, interlocking switches at grade crossings, block signals between Chicago and Kensington, new elevator at New Orleans, freight house and train shed for new passenger station at New Orleans, and other minor matters, estimated at $1,000,000. As will be seen from the above statement, the bulk is on account of the World's Fair.

We copy from the circular issued to the stockholders as follows: The site of the former passenger station in Chicago, owned jointly with the Michigan Central, having been found inadequate, the erection of a fire proof building for general offices in connection with the passenger station has been undertaken, at an estimated cost of $1,000,000 for both, on a site to be provided by removing the Weldon shops. Although no contracts have been concluded, there is reason to expect that roads using this company's tracks in Chicago will use the station and pay adequate rents therefor. The erection of new shops at Burnside, ten miles further south, has been undertaken on a plan which will admit of gradually concentrating in one place the work of the machinery department. This work has heretofore been done at great disadvantage in various small shops which have become overcrowded and cannot be economically enlarged.

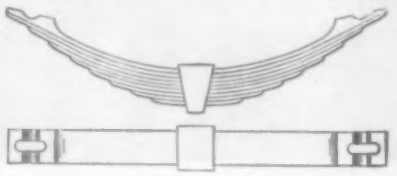
The holding of the World's Fair, at Jackson Park has made it necessary to raise nearly two and a half miles of the railroad above the grade of the streets entering the park from the west. The outlay for that purpose, including the depression and reraving of the streets, is estimated at $1,360,000, of which $350,000 will be borne by other interests benefited by the change. As no other railroad connects the City of Chicago directly with the site of the exposition, improved passenger service must be provided for this eight miles. The equipment required for such service was last year estimated as 50 engines and 500 coaches, costing $2,100,000. It will probably be decided to build less than this number, but the number of passengers coming to Chicago during the exposition from distant points will be large, while the company's passenger equipment is barely sufficient for present demands. Additional coaches, baggage-cars and engines must be purchased. The increase in the exports of grain by way of New Orleans (5,000,000 bushels in 1890, 23,000,000 in 1891-2) will require the erection of an elevator at that point, and the growth of the traffic in other respects has compelled the building of a new freight house and a train-shed adjoining the new passenger station at New Orleans.

Grade crossings are being interlocked, block signals are being introduced, and other minor works are under way and in contemplation at various points.

While the greater part of the outlay is for matters connected with the passenger service, and chiefly in and around Chicago, it must be borne in mind that in the last four years the total passenger earnings have increased from $3,037,743 to $4,388,289, and that the suburban business in and out of Chicago has furnished more than its share of the increase, having grown from $464,534 in 1888-89 to $762,017 in 1891-'92.

V-Shaped Bands for Semi-Elliptic and Elliptic Springs.

The spring shown has a "V" shaped band in place of the usual rectangular band. The advantage is a reduction of the breakage of the shorter plates of the spring. The tendency of the main plates is to leave the outer edges of the band when loaded, thus relieving the pressure of the band on the main plates. At the same time the short plates are forced against the band, rendering them liable to breakage. With less width of band on the short plates, the pressure is decreased, giving an easier and increased motion to the spring and reducing the liability of breakage. The carrying capacity is not reduced by the use of this V band. The spring has been shown to be durable in service, having been in use several years with a considerable reduction in breakages. It is manufactured by the A. French Spring Co., Limited, Pittsburgh, Pa.



The New South Wales Locomotives.

In our issue of July 15 we published abstracts of the evidence of Mr. Eddy and Mr. Neale before the Royal Commission, inquiring into the matter of the purchase of locomotives from the United States for the railroads of New South Wales. We give below further extracts from Mr. Neale's evidence. It is not necessary to state again what our readers already know as to the origin and animus of this inquiry.

The design of these engines is modified from that of some used on the Baltimore & Ohio. A screw reversing gear is used as an extra precaution on our steep inclines should both the other two methods of stopping the engines fail. These and minor modifications are in accordance with the universal practice on the New South Wales Railways. . . . Investigation showed that the Baltimore and Ohio engines were slightly more powerful than required here, and as in our climate engines are less liable to slip than in colder countries, some reduction in weight was possible without unduly reducing the tractive power of the engines. . . . The engine truck axles have proved to be of inferior material, but it is certain that this could not have been detected by an examination or test in general use. The only method would have been to have subjected these axles to a drop test, which is very unusual with scrap iron axles. These axles now cost considerably more than steel, and the whole business of the maker depends on his supplying a first rate and trustworthy article.

Steel being cheaper, has very generally superseded Yorkshire or scrap iron as a material for axles, but in the axle which has the hardest service, the crank axle of a locomotive, iron was a few years ago more frequently used than steel. The latest return on the subject was made by the railways of Great Britain to the Board of Trade in 1883 and shows that 6,988 iron crank axles were then in use against 5 955 steel.

An examination of the Board of Trade returns shows that the breakage of an axle seldom involves serious consequences. During 10 years 255 leading or trailing axles of locomotives broke, and a careful search shows that only two accidents resulted and only one life was lost, the axle having run 619,414 miles and being flawed.

The wheels are not only perfectly sound, but the principal parts, the boss, the rim, and the spokes being all made without any *transverse* welds, a bad weld cannot cause a failure of a wheel. The welds in the spokes and rim run lengthways, and therefore even if faulty are only equivalent to lamination in rolled iron. At the base

* Mr. Wheeler prefaced his address with a reference to Mr. Arthur Hale's paper on the "card catalogue plan" of keeping car records, which was read at the previous annual meeting and which was reported in the *Railroad Gazette* of Sept. 25, 1891. That paper gives details which are of special interest in judging of the merits of Mr. Wheeler's block plan.

of each spoke a small triangular filling piece is welded in more for uniform appearance than for strength, and in a few places the joint of the weld can be seen, but this is of little consequence. The slight marks on the spokes near the boss are caused by the fin or overlap of the iron. It is usual to putty up the rough places as left by the smith so as to leave a smooth surface for the paint. The breakages of reversing gear and valve buckles is in my opinion due to the introduction of unsuitable lubricants.

The power of the engines does not unduly strain the draw gear. . . . The fact that changes of grade and not the power of the engines break draw gear is very generally recognized by engineers. The engines in question have ample boiler power and are therefore very unlikely to have a stop for want of steam on a gradient, while their great power and the ease with which the driver can control the power by the throttle enables them to start a train gradually and steadily without the jerk of a smaller engine. . . .

I have examined the compounds on our lines and found that owing to inexperience on our part one or two small matters wanted some slight readjustment. I feel satisfied that they are capable of doing excellent service; one of them hauled 2,600 tons when tried in America.

I consider that the engines are thoroughly adapted and perfectly safe on our permanent way for many reasons. In the first place, as American engineers use light rails, sharper curves and less ballast than in Great Britain, the American builders have always been distinguished for making engines which are easy on the roads, and it is an undoubted fact that taking two engines of equal weight the American engine will be easier on the road than the English engine. This is a matter which no Englishman who has resided in the United States and Canada will attempt to deny, and, as a matter of fact, though the mechanical officers of the two principal railways in Canada, with most of whom I am personally acquainted, are without exception of English or Scotch extraction, their practice is to use engines designed entirely in accordance with an American practice, the only departures being in small details such as safety valves, which have no reference to the running of the engine on the track. I have discussed this matter with Mr. J. Davis Barnett, ex-President of the Master Mechanics' Association, an Englishman brought up at the works of the Great Western Railway in England, and in the strongest possible terms he assured me that the English methods of applying springs to an engine and dividing the weight among the wheels had in his experience utterly failed.

In the engines under discussion the weight is distributed over ten wheels, whereas in all our previous engines it was distributed over eight wheels. It is obvious that the addition of 25 per cent. to the number of wheels, or guiding points, distributes the weight on the rails. The rigid wheel base is 12 ft. 6 in. Comparing the engines with the previous passenger engines known as the "Middleton Moguls," or "Scotch Yankees,"* and against which no accusation is made that they are too hard on the road, we find the following differences:

The 10-wheeled engines have 2 ft. 6 in. less rigid base. The front end of the engine is guided round the curve by four bogie wheels instead of two. The heaviest loaded axle has no flange, and therefore the heaviest loaded axle cannot strike the rail sideways on a curve, whereas in the moguls it has to do a large share of the guiding of the engine, being the leading wheel of the rigid wheel base, and therefore sharing with the bogie wheel the work of guiding the engine round a curve. In the 10-wheeled engine the leading coupled wheel not only strikes the curve at a more favorable angle—that is to say, more nearly tangential to the curve, but is preceded by a 4-wheeled truck instead of by a 2-wheeled truck. I, therefore, claim that in the 10-wheeled engine the duty of guiding the engine round the curve is shared by 6 wheels, the maximum weight on any pair of which is 13 tons 15 cwt. In the "Scotch Yankee" this duty has to be done by four wheels, the maximum weight on any pair of which is 15 tons 1 cwt. As the diameter of the wheel and the total wheel base of the engines are not materially different, the 10-wheeled engine must be both safer and easier on curves than the "Scotch Yankee," which is a mogul engine.

A table compiled from the best authorities shows that in American practice much heavier weights are used on thousands of miles of line on lighter rails than we have in use in this Colony. The safety of permanent way depends more on the ballast, sleepers and fastenings, than on the weight of the rails. The greater portion of derailments take place not from broken rails, but from faults in switches and in crossings, in undrained ballast, insufficient ballast, imperfect packing of the ballast under sleepers, undue speed while the line is being opened out and the ballast removed, rotten sleepers, inefficient fastenings and miscellaneous causes. The most important element is perhaps the question of fastenings, and while the English roads use the heaviest rails in the world, a study of the Board of Trade returns shows that notwithstanding this, they still have derailments from the causes I have enumerated above, and especially because the spikes and bolts, when driven into the deal, fir and spruce sleepers, used at home, get loose. This is due to the soft character of the timber. Our railways are fortunate in having the hardest and heaviest sleepers known in the world. The fastenings once driven in remain tight and secure the rails firmly to the sleeper. In all American railroad practice the spikes are continually working loose owing to the sleepers being too soft to stand the strain. Under these circumstances the Americans find it absolutely necessary to use a very large number of sleepers. The quick decay of sleepers both in America and England is another feature which very unfavorably affects the stability of the permanent way. On our lines the gray iron bark sleeper has the most marvelous vitality, it remains hard and sound for even thirty years and therefore the fastenings are rarely loose, and I am certainly of opinion both from inspecting the track and from riding on the engines that our lines cannot be termed weak, though it is in places rough owing to the rails being worn irregularly and out of line and surface. It has been immensely improved in the last three years and the difference is very perceptible in the riding of the engines.

I have carefully studied the English Board of Trade returns, and have compiled a table from all the returns I have been able to procure in Sydney. They show that in 12½ complete years 6,005 rails have broken, with only one loss of life and injury to 41 persons. In one year 828 rails broke on one railway, but no one was injured. Particulars of cases of derailment from broken rails as given in this table show clearly:

1. That, notwithstanding the heavy rails used, rails break frequently in Great Britain.

2. The breakage of a rail very rarely causes loss of life or even derailment.

3. That the accidents from broken rails are very few in comparison with those from other causes, one life having been lost from a broken rail in twelve and a half years, while over 13,000 persons met their deaths from other causes in the conduct of public traffic, for even this total does not include those fatalities taking place on stationary vehicles etc.

*Built by Dübs, of Glasgow, with bar frames.

Compressed Air for Street Cars.*

In view of the objections to the overhead electric system for propulsion of cars on surface roads in cities, the annoyance from tearing up streets and the cost of plant and maintenance of the cable lines, the expense of horse power, with the sanitary evils resulting from the location of stables in populous cities, the fact that pneumatic motors, after a successful demonstration of their superiority, have been largely overlooked, seems inexplicable. These motors not only are entirely free from the objectionable features of the other systems, but they furnish a mode of propulsion which is more safe and more economical than any other with equal velocity of transit. These assertions are made advisedly and are based on actual demonstration. In 1878 and 1879 five pneumatic motors were constructed upon the plans and under the supervision of James Hardie, Mechanical Engineer, and were run for several months on the Second avenue railroad in New York with perfect success. In 1879 the writer was called upon in the interest of proposed investors to investigate and report upon the practicability and expediency of using pneumatic power for street railroads. The comparative results were overwhelmingly in favor of motors of this class, but all attempts to secure their general introduction at that time proved failures. The company could make no progress, and finally abandoned all effort, losing the capital expended in plant and demonstration, and no attempt to revive the motor has since been made.

Conditions existing now seem favorable for the introduction of a motor which, free from the objections to all other systems, with no new defects of its own, may be considered as perfect. No fears are now entertained that a car running without horses in front will make a stampede of all equines on the streets traversed, and this in 1879 was the only reason urged in opposition to the introduction of the pneumatic motor. It is possible, therefore, that a few extracts from the report made in 1879 may be of interest at this time.

The compression plant was located in Harlem in New York, on the line of the Second avenue railroad. It developed 66 H. P. and charged the cylinders under a car with compressed air in seven minutes. With proportionately larger plant not more than one minute would be required. The report of Mr. Hardie stated the capacity of the cylinders under the seats at 17,000,000 foot-pounds of work, capable of running a car 16 miles on a level. The effect of the compressed air was greatly increased by passing it through a tank of hot water at the temperature due to 82 lbs. pressure. The tank had a capacity of five cubic feet and was placed on the side of the platform. A duty of nearly 50 per cent. of the horse power used in compressing air can be secured from the expansion and utilization of dry air when compressed. By the addition of a heater and passing the air through hot water an increase of nearly 100 per cent. power can be secured at a merely nominal cost. On a straight and level road, with 100 cu. ft. of air in the reservoirs, under an initial pressure of 350 lbs., the motor would run seven miles with a reserve of one-third left in the reservoirs on its return. This result assumes that the amount of air expended at each stroke is equal to a full cylinder of air expanded to atmospheric tension, but actual work has demonstrated an ability to run 10 miles with a single charge, proving that less than this quantity is sufficient. The back pressure which would result from working against a vacuum is relieved by suction valves in the exhaust passages. In descending grades the motor cylinders act not only as brakes, but also as air-pumps, and have power to pump back into the reservoirs against a pressure of 200 lbs., sufficient air to raise the gauge pressure 7 lbs. in running 2,100 ft., and restore sufficient air, when heated, to run the motor half that distance upon a level. By this remarkable contrivance power can be stored on descending grades. The down-hill portions not only use no power, but give back a portion of that which was expended in ascending. The compressed air can be used expansively to any extent, and cut off at any part of the stroke. It can act as a brake, or the motor can be instantly reversed, and the braking apparatus is exceptionally complete and satisfactory.

The power of an eight ton motor is sufficient to propel three cars on a straight and level road. With full power in the motor cylinders and full adhesion on the rails, the motor can overcome grades of 300 ft. to the mile. Although, during a run, the pressure in the reservoirs is constantly diminishing, yet, by means of a reducing valve, the working pressure in the motor cylinders is maintained at a constant limit. Each motor, allowing for increased speed, would take the place of 10 or 15 horses, the cost of which would about equal the cost of the motor, $1,500. With the small class of motors, three cars, or two in addition to the motor, can ascend grades as steep as any usually found on horse railroads.

Compressed air can be transmitted to any distance without loss except for friction in pipes. If pipes are large and velocity low the loss will be inconsiderable. To charge motors at a central station a nozzle between the tracks and a short piece of pressure-hose to screw on to the air reservoir is all that would be required to connect with reservoirs located in a building. It would not be necessary to run the cars into a house to renew the air supplies. The running expenses are less than one-half—in fact, the estimate shows less than one third—the cost of horse power. The motors run without noise, ashes or smoke, are perfectly under control, and would furnish the best possible power to operate elevated railroads. Skilled engineers are not required.

The car acts as its own governor, and no more air can be used than is necessary to overcome the resistance; there can be no waste. At a speed of twelve miles per hour the motor can be stopped on a level within its length, and the braking apparatus cannot get out of order so long as the motor can move at all. The pneumatic motor would be peculiarly adapted to underground roads, as the escape of pure air would assist in the ventilation, but it is the best possible for all urban or suburban roads, whether elevated, surface or in tunnels. In this paper results only have been given, but the full report made in 1879 gives the facts upon which the conclusions have been based.

*Abstract of an article by Gen. Herman Haupt, in the *Engineering Magazine*, August, 1892.

Tests of Steel Tires and Axles in England.

Last week we said something of the standard requirements for axles and tires in England. The following are results of the average tests of steel tires and axles on the English railways:

Tensile Strength and Elongation.

	Engine Axles.		Passenger and Freight Car Axles.	
	Tensile breaking strain, lbs. per sq. in.	Elongation, per cent.	Tensile breaking strain, lbs. per sq. in.	Elongation, per cent.
Average of English Railways	74,000	26 in 2 in.	85,000	24 in 2 ins.
Vickers' tests	76,000	26-25 in 2 in.	76,000-87,000	26-25 in 2 in.
	Engine Tires.		Passenger and Freight Car Tires.	
Average of English Railways	103,500	20 in 2 in.	90,000	25 in 2 in.
Vickers' tests	over 105,000	10 in 2 in.	over 105,000	10 in 2 in.

Drop Test, Axles.—One ton (2,240 lbs.) falling at least 20 ft., the axle being placed on solid iron supports 3 ft. 6 in. apart, and turned after each blow, the number of blows being at least five. A bar about 1 in. square, machined from the axle and not drawn down by a smith, should stand being doubled close while cold without fracture.

Drop Test, Tires.—The drop test similar in weight, fall and number of blows. Tire to be compressed one-sixth internal diameter before fracture.

Vying with Pullman and Wagner.

The Queen's two railway saloons for Continental journeys, which are the private property of Her Majesty, are kept in Brussels to be placed at the disposal of the Empress Frederick when she comes to England in September. These carriages, which are connected by a passage, are fitted with electric bells, and lighted with oil lamps, as the Queen does not like the electric light for reading and writing. The day saloon is furnished with sofas, armchairs and various kinds of footstools, all covered in blue silk with fringes and tassels of yellow; the walls are hung with blue and pearl-gray silk brocaded with the rose, shamrock and thistle in yellow. There are a writing table of walnut wood, two small tables and one on which meals are served during a journey. The floor is covered with an Indian carpet of dark blue and the curtains are blue and white. There is a separate compartment in front for the Queen's Highland attendant, Francis Clark, successor to John Brown. The night saloon is a larger carriage divided into several compartments. The dressing-room is decorated in the Japanese style, and the floor is covered with bamboo. There is a white metal bath and toilet service. The large basins on the washstand, which is covered with dark red morocco, are of the same material. The bedroom is decorated in gray and light brown, and contains two beds. The larger is occupied by the Queen, the smaller by Princess Beatrice. There is another compartment in which is stowed the luggage needed by the Queen during a journey, and the two maids who occupy it sleep on sofas. (How horribly plebeian!)

A new and luxurious royal train has just been completed at Malines for the use of the King and Queen of the Belgians. It includes saloons, study, bedroom and a *cabinet de toilette*. These compartments may, if there is need, be further subdivided by heavy draperies. Teak wood has been mainly used in the construction, but the moldings and the exquisite veil ivoire panels used in decoration have come from Austria. The Belgian royal train, though less showy, competes in all other respects with that recently arranged for the German Emperor.—*London Correspondent New York Tribune.*

The Gold Train.

"I want no more gold trains," said one of the brakemen at the depot yesterday. "It is enough to make the hair of an ordinary man stand on end to see the way the treasure was guarded. A private car with the observation end toward the engine led the van, and in the car were two men with revolvers carrying a ball as large and as long as your finger. Besides these they had two Winchester rifles, and they watched both sides of that engineer's cab as intently as a cat watches for rats. Every time I moved four men with drawn guns would appear behind me, and where they came from I could not tell. No matter who made a move these men would appear like spectres, and in the darkness (not a light was allowed on the train), it would scare any one at all superstitious. Trainman Henry Weil was scared out of a year's growth by the appearance of the men as he was about to take a drink of water. Next time one of these trains comes through I'll have an extra man handy."—*Buffalo paper.*

Superintendent Troy, of the Railway Mail Service, who had charge of the train which carried $20,000,000 in gold from the federal treasury in San Francisco to the sub-treasury in New York, tells a reporter that he has no desire to repeat the experiences of the trip. The publication of the fact that the train had started increased the danger that robbers might attack or attempt to wreck the train. The guards were in the front car, so situated that they could protect the engineer and firemen with their Winchesters. The party had two or three bad scares on the trip. At one point in the mountains the brakeman who placed a torpedo on the track, warning that there was a train in front, came near losing his life as a train-wrecker when it exploded. At another point in the mountains a lot of tramps, who were hiding behind rocks where the train stopped, made a dash to board it as it started, but beat a precipitate retreat when confronted by the glistening barrels of a score of rifles.

A Washington reporter learns that the lowest bid the Treasury Department could obtain from an express company for carrying the money was $3 per $1,000, or $60,000. The Wells-Fargo made this rate. From the same source is given an estimate of the cost of transporting the gold as mail matter, $3,500, which probably includes a good deal of guess work.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday.
At 73 Broadway, New York.

The subscription price is $4.20 a year in North America, and $6.08 in foreign countries.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The *Railroad Gazette* is pleased to be able to announce that it has secured the services of Prof. Arthur T. Woods for its editorial staff. Mr. Woods has become well known as Professor of Mechanical Engineering at the University of Illinois, and more recently at Washington University, St. Louis, as well as for his writings in the technical press, particularly in the *Railroad Gazette*. The reader will also be familiar with his name as the author of the work on "Compound Locomotives," published in 1889. Mr. Woods will be stationed at Chicago, where he will work in association with Mr. D. L. Barnes, who will still hold the same position on the staff of the *Railroad Gazette* that he has held since January, 1889.

The address by Mr. E. B. Wall before the Alumni Association of Stevens Institute which appears on another page contains a very attractive idea. It is that of teaching in the technical schools something about the organization of railroads, manufacturing establishments and other great industries, in which engineers are likely to be called to important administrative offices. The organizing talent is probably that which it is most difficult to find, and which is highest paid. To impart this talent to the man who is not born with it is impossible, but there does not seem to be any adequate reason why the young men who leave the technical schools should not start with at least a fair knowledge of what other men have done in organizing work. An effort is made in the Massachusetts Institute of Technology to teach something of railroad organization. Mr. Allen's lectures in the fourth year of the Institute course deal somewhat with railroad management and with operating organization. At that Institute, also, lectures have been delivered by specialists on shop management, but we believe that this has not been carried very far. We should suppose that a course of lectures in which general principles are laid down and illustrated by good practical examples would not only be very popular, but extremely valuable to the senior classes in any of the engineering schools.

The loose notions concerning human liberty and the rights of property which have been so much encouraged by vague and sentimental thinkers since the Homestead trouble began appear to be producing their logical results in various places. Last Saturday the switchmen in the yards of the Erie and the Lehigh Valley at Buffalo struck for higher pay, and the strike was attended by the usual forms of violence. Freight cars, loaded and empty, were wrecked and set on fire, and up to this writing the direct losses from destruction of property amount to probably $100,000. On Tuesday troops were called out, and this checked somewhat the energies of the strikers. The railroads promptly notified the civil authorities of the need for protection, and presumably intend to hold the city and county responsible for damages. This, after all, is one of the first steps to take to correct such troubles. When the taxpayers find that they have to pay for the rioters' fun, they will begin to take a more serious view of these performances. Undoubtedly the good sense of the great mass of the American people is sufficient to lead them to take the right course, when they once realize that matters are actually serious, but the American nature and sense of humor prevent many people from taking strikes seriously so long as they are not immediately affected. We do not look for any social revolution nor for any legislative remedy for the propensity of men to strike when they are not satisfied, but we do expect that existing laws will be more firmly enforced as people learn the actual costs and dangers of the trade union methods of settling differences with their employers. It does not follow that trade unions will lose anything of their present power and authority; on the other hand they will probably gain, but they will learn more and more accurately their responsibilities toward society, and will discover that they, too, will have to compromise, as all the rest of us must. The union involved in the present trouble, the Switchmen's Mutual Aid Association, is probably one of the most pernicious of them all. Repeated successes in striking and in scaring railroad officers have puffed them up beyond endurance, and they have succeeded in raising their wages until to-day they are probably paid more than any other class of railroad men, considering their duties and the amount of skill and intelligence that those duties require. About 15 months ago the Chicago & Northwestern faced this union resolutely and successfully in Chicago. We trust that the same thing will be done by the railroads involved at Buffalo, for that is the only way to emancipate themselves from the costly tyranny of an irresponsible and ignorant body of men. So far as we see now, we only wonder that they have not done it before. It is not conceivable that these highwaymen, would-be murderers and lesser criminals were thoroughly peaceable citizens up to midnight of Aug. 12, and a railroad officer who keeps ruffians in his force must know that they are at any time liable to act out their true nature, especially if they are banded together, with ignorant or unprincipled men for leaders.

Cast Iron Car Wheels.

The man who writes us about cast iron car wheels and whose letter appears on another page, has been familiar with this subject for years. He has taken part in the negotiations between the Wheel Makers' Association and the railroad technical associations and has had a good deal to do with developing the present system of tests and the standard specifications. Moreover, besides being a well informed man, he is a judicious man, and therefore what he says deserves respectful attention.

It will be noticed that the principal point that he makes is that under present methods of buying car wheels, the manufacturer has no object in making a wheel any better than those that just fill the requirements of the tests and the guarantee, and that the intense competition in this business keeps the price down to such a point that the manufacturer cannot afford to be liberal. If he just gets his wheels accepted and fills the guarantee and nothing more, he is fortunate if he makes any money. We are confident that this last statement is within the limits of accuracy. We doubt if at the present competitive prices for large orders a safe and durable wheel can be made and still leave such a margin of profit as a sound manufacturing business demands. Still, within the last two years the prices of pig iron have fallen so much that the wheel makers' business to-day may yield a little more profit than it did three years ago; for he can get, we will say, about 1½ cents per lb. for his wheel, and he can buy pig iron all the way from $12.50 to $26 per ton, and of course the profit will vary according to the amount of scrap wheels and ordinary forge iron he uses. The safety and durability of the wheels also will vary according to the same elements.

We have long held that wheels should be bought on tests and specifications, for we do not believe that the place for an original test of a wheel is under a car. We have also held, however, that the railroads would find it economy, and the best wheel makers would find it to their advantage to have the basis of payment take into account the mileage made. Of course this is taken into account according to the M. C. B. form of contract up to the guaranteed life, but it does not seem necessary that the premium for good wheels should stop there. The guarantee for passenger wheels varies from 60,000 to 70,000 miles, according to the size of the wheel, and for engine and tender wheels from 40,000 to 60,000. The objection which we have always heard urged to basing the payment upon the total life of the wheel is that the complication and cost of keeping the accounts are too great.

It sounds plausible to say that by an adequate system of tests and proper specifications the machinery of record and accounting can be reduced to its simplest form; that the question whether or not a wheel failed from faults or misuse need not enter; that the element of great difference in service between one road and another or one part of one road and another part, is taken out and that the maker need concern himself only to make a wheel that will stand the test, and the railroad company only to know that it buys such a wheel. But there is something beyond. If by paying for a long life wheel according to its life, the railroad company gradually raises the quality of its wheels, it gains in several ways. The additional safety is the greatest gain, but beyond that is the saving of the cost of replacing wheels; that is, of the work of taking out the trucks, taking off old and putting on new wheels and the cost of holding the car out of service. It is probable that these economies would more than offset the increased cost of the more complicated records and accounts.

The conference of the committees of the Wheel Makers' Association and the Master Mechanics' and Master Car Builders' Associations have gradually developed a very good system of tests and specifications and guarantee, but it is likely that more can yet be done in the same direction, and will be done. We ask special attention, therefore, to the suggestions in the closing paragraphs of "Inquirer's" letter.

A Practical Point in Discipline.

Major F. A. Marindin, one of the railroad inspectors of the British Board of Trade, holds that the only sure way to make enginemen run at a properly reduced speed over a critical place in the road—say a steep descending grade in a tunnel—is to compel them to regularly stop before entering upon that piece of road. We discussed this point in the *Railroad Gazette* of May 20 last, and invited American superintendents to give their views upon it. We have not received many responses, and of those we have received there are about the same number that agree with Major Marindin as that condemn him. But it is, we think, undeniable that the *practice* on American roads is largely in favor of the theory that a runner can be made to run at a safe speed over a certain place as surely as he can be made to stop there. Perhaps the very elastic construction put upon the term "safe speed" by many Americans is the explanation of this. But without further generalizing as to what kind of theory or practice preponderates, we present the theories and practice of one superintendent who has written more at length than the others. He is on a progressive Western road. After introducing the subject he writes:

> My trainmaster says: "Men can be educated to observe slow orders without coming to a full stop. . . . This, of course, requires a strict enforcement of the rules. . . . There can be no assurance that they would comply with the order to come to a stop any more than they would with a slow order."
>
> My road foreman of engines says: "Men can be educated to know that a slow post, a caution flag or a slow order on the bulletin board indicate dangers as real as those covered by a red flag, and they will govern themselves accordingly."
>
> My own opinion is that the action of an engineman under any given rule is, like the actions of other people, controlled largely by his feelings as to the reasonableness of the rule. Enginemen constantly "run" the grade crossings on the open prairies, notwithstanding the law makes such action a penal offense, because they approach the crossing under conditions that make the rule seem absurd. We have to day on the 125 miles of our main line six slow orders in effect: Two because of land slides where the bank is gradually going into the river, two because of putting in slag ballast, one because of strengthening a bridge floor system, and one because of a bridge abutment washed out. Our practice is to put a slow order under the general notices on the bulletin board, and to put up semaphore slow posts, with green lights at night, on either side of the obstruction. These slow orders are not put up unless the maintenance of way officers make out a good case, and we keep after them pretty vigorously to have them removed. The enginemen have come to understand that they mean what they say, and I am satisfied are observing them strictly, except in the case of the "slides," which are of long standing, and where, after a prolonged spell of good weather, the speed may be increased. I believe if you can convince your men of the reasonableness of your rules and of your disposition to steadily and rigidly enforce them, you will have no trouble in getting the rules obeyed.
>
> Other objections than that of non-necessity lie to the recommendation of Major Marindin. My trainmaster points out one: "That you cannot be sure that your 'stop' rule is being any better observed than your slow order." Again, as in the case of our bridge floor, it might be a great deal worse for a train starting up a grade to be using steam over the bridge going four miles an hour than to roll over it at ten miles an hour, and thus the very object of the order be defeated. Again, there is the delay to the traffic, and what is more tangible, the actual cost of the practice. I have looked over an estimate of the cost of making a stop, which places it at 18 cents, a sum which seems to me reasonable. With a traffic of 65 trains daily, the cost of carrying into effect the major's recommendation would be $11.70. If some extraordinary check were still thought necessary a day and night watchman might be put on, and money, time and inconvenience saved.

The gist of our correspondent's statement is in the last

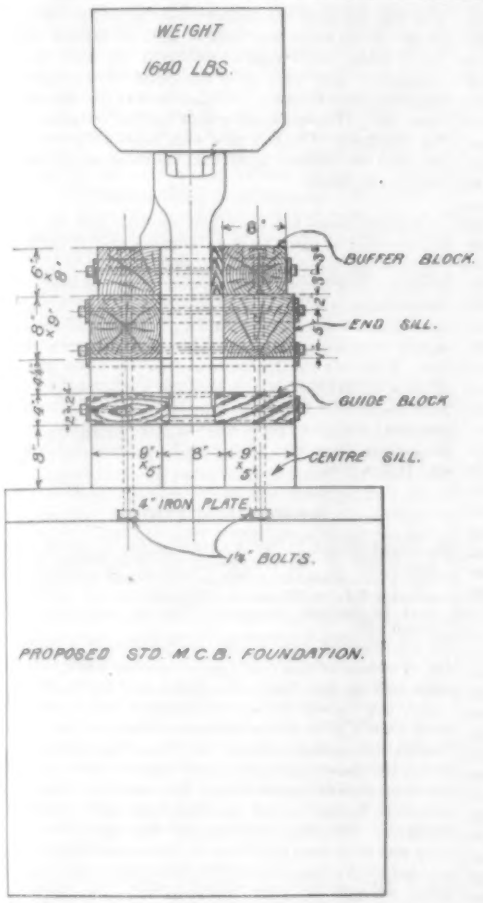


Fig. 1.

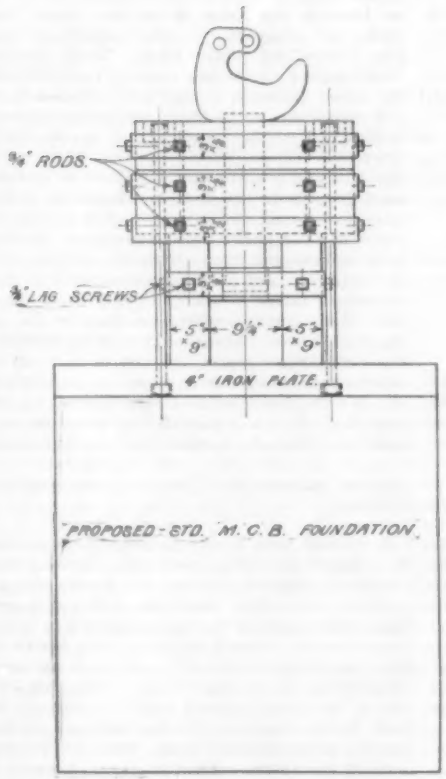


Fig. 3.

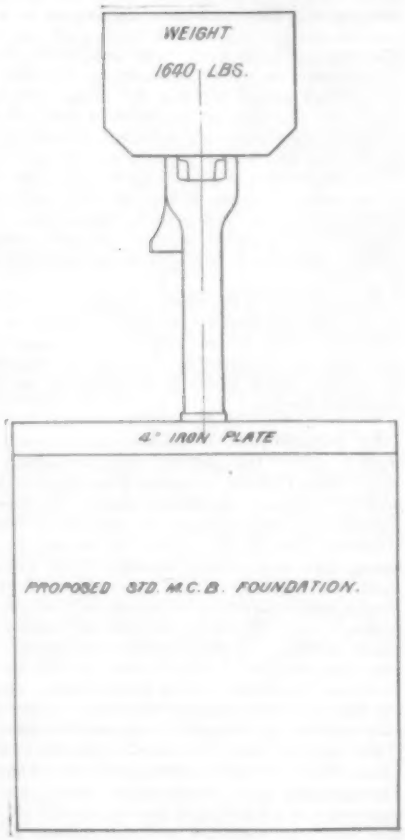


Fig. 4.

METHODS OF TESTING COUPLERS.

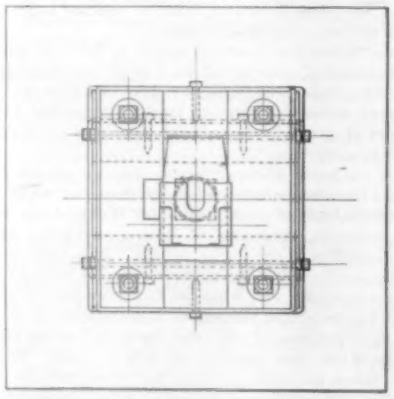


Fig. 2.

sentence of his paragraph next to the last. Convincing men of the necessity of things which they think unnecessary implies talk, and this again implies more road foremen of engines than most roads now think it profitable to employ. The "disposition to enforce," etc., means much more than to say that violations have been punished in the past. A superintendent who means to enforce rules means to detect neglect. The feeling that he will overlook small derelictions accounts for half the carelessness we see. We know one superintendent who reins up his men about once every month on the question of speed at a certain point where a certain slow rate is important. In other words, he has to remind them every month that they have forgotten that he is disposed to enforce his orders. Perhaps the reader may regard this as a negative point in an argument intended to show that discipline can be improved; it may be considered as proving that human nature is totally incorrigible; but it shows that one superintendent realizes what discipline means and that he does not trust men to use their own judgment simply because he finds that judgment hard to train. And the reining-up process does not consist in merely posting a notice on the bulletin board.

The estimate of the daily cost of one stop for 65 trains is very much to the point, and the estimate of cost is probably low if it errs either way. It suggests that small savings often result in big losses, and what is equally to the point, that watching enginemen, conductors and brakemen is a legitimate part of the business of running trains. This, however, is one of the principal difficulties in maintaining discipline and one that we did not touch on in our article on this subject, July 29. The superintendent who sets out to follow our injunction to test his enginemen finds it hard to get the right men for road foremen—the men to act for the superintendent, and do it for a sum equal to about one-half or one-third the superintendent's salary. If a runner is promoted to this position he is hampered by his familiarity with his late associates and is inexperienced in the art of imparting information, and it takes pluck to discipline his old friends. One of the best men of this class that we ever knew of did well for a few years, but then his courage failed him and he resigned. Perhaps he was made of a little too sensitive stuff. An old army officer tells us that an orderly sergeant ought to be able to lick any man in the company. Perhaps the road foreman of engines ought to be able to whip any runner on the road. At any rate he needs to have "sand." When a runner cannot be found for the job the superintendent must act himself or must get an outsider. As to himself he cannot find the time. To look after his men properly he ought to have half or three-quarters of his division cut off. To get outsiders he knows not where to look. Men for these places are like poets—they are born, not made.

Various points will suggest themselves to the practical man. We will mention but one that was recently brought to our attention, to wit, to have the chief signal officer keep watch of how enginemen obey signals. Few roads have supervisors of signals, but all the large ones ought to have them, and a man with the training that naturally comes to him in this department is likely to be a good monitor. Such an officer would have to step out of his field, as it is now laid out, but what harm in that, provided, of course, that he be not overworked? One reason why good men do not like to make a business of finding fault—as a road foreman has to do—is because they are compelled to do so much of it. There would be a gain in assigning the fault finding to an officer who spends most of his time in doing something pleasanter.

Methods of Testing Couplers.

The proposed Master Car Builders' standard tests for vertical plane couplers subject the couplers to strains which cannot be duplicated in service. The best plant proposed (See *Railroad Gazette* June 24, "Report of Committee, Automatic Coupler Standards and Limits") consists of a 4 × 4 × 4 ft. stone foundation, and although not specified it is generally understood that it is to be capped by an iron plate, presumably about four inches thick. Above this is to be placed framing with guides and suitable lifting mechanism for a 1,640-lb. weight similar to the axle drop. Upon the iron plate and directly beneath the centre of the falling weight the coupler, with knuckle in closed position, is to be placed vertically, resting on the end of the barrel. The impact of a blow received from the falling weight is transmitted from the knuckle head to the barrel.

No car in use in this country and no class of service would subject a coupler to the strain as this which is proposed. Considering carefully the conditions under which a coupler is placed in service, one will see that the M. C. B. proposed standard test does not subject the coupler to anything like service conditions. In service the coupler is hung between the draft timbers and the centre sills and is supported just back of the head by a yoke or carrier iron and at the other end by the tail bolt or yoke and the follower plates. All standard M. C. B. couplers are provided with a buffer stop, and all others should be. This stop strikes the dead block on the end sill when the draft springs are compressed. In order to duplicate in a test the strains to which a coupler is subjected in service, it is necessary that the blow should be absorbed by the buffer stop, and the coupler held in as nearly the same position relative to the direction of the blow received as if on a car. Otherwise, a coupler may be made to stand a test and yet be weak in service. It cannot be said that the proposed M. C. B. tests fulfill these conditions, nor that the strains received by couplers under those tests are of the same kind as those received in service.

In figs. 1, 2 and 3 are shown a proposed method of making M. C. B. tests of vertical plane couplers. It differs from the proposed M. C. B. tests, see fig. 4, in that the coupler is placed nearly in the position and under the conditions of service. There is a framework of timbers approximating to the arrangement of the underframing of a car. Two complete sets of timbers are required, arranged as shown in figs. 1, 2 and 3, viz., two sills 9 × 5 in. × 16¼ in. long, of Georgia pine placed on end, 9¼ in. apart, to represent the M. C. B. centre sills; these capped by one 9 × 8 in. oak block 27 in. long to represent the car end sill, and this in turn is covered by a block of oak 6 × 8 in. × 27 in. long, representing the dead block. Two sets of these timbers are assembled as above and spaced 8 in. apart by means of four spacing blocks of wood placed between the end sills and dead block. The blocks are 6 × 6 × 8 in. The whole is then surrounded by by four bands of ½ × 3 in. iron, screwed and bolted, as shown in figs. 1, 2 and 3. The third band from the top surrounding the end sills overlaps the end sills 1 inch and serves as a guide to the centre sills when assembling the parts on the iron block preparatory to binding them together. Between the centre sills there is placed an oak block 4 × 9¼ × 26 in. long and having a 5⅝-in. hole through its centre. It is placed 4½ in. below the upper end of the sills. A band of ½ × 3-in. iron surrounds these sills, as shown in figs. 1 and 3, and is secured by ⅝-in. lag screws. The frame is then placed upon the iron plate surmounting the foundation and is tied down by means of four 1¼-in. bolts passing through the end sills and dead block, as shown in figs. 1, 2 and 3, the nuts on the upper end of the bolt being countersunk into the dead

blocks so as to leave its upper surface free from obstruction. On one of the dead blocks is placed an oak or ash guide block 6 × 4 in., cut out to receive the barrel of the coupler. This block keeps the coupler in a central position and prevents it from turning after having been placed in the frame work. The coupler is to be placed in the frame, the end of the barrel entering the opening in the block placed between the centre sills, see fig. 1. The buffer stop rests on the oak dead block, as shown.

None of the timbers are mortised, tenoned or framed in any way, and broken pieces can be replaced quickly. With this method of assembling the parts, sawed blocks of the right length can be kept in stock and replaced in a very short time. This plan is suggested in order to show how it is possible to obtain conditions more nearly approximating to those which the coupler has to meet in service.

If, in addition to the above changes in the conditions of the tests, the drop weight have a shape on its lower side of the same general contour as a coupler knuckle, then the blow would be delivered on the coupler tested at the same point where it is struck by an opposing coupler in service.

All practice must be founded on theories, but that doesn't hinder the practice from sometimes getting ahead of the theories, or rather from demolishing some accepted notions concerning them. We have lately noticed a striking instance of this on the Manhattan elevated, a road which can test its theories by practice better than most roads, because it has such a large amount of the latter to the square inch. Such a road cannot long do anything dangerous or wasteful without finding it out. The theory we refer to is that a mechanical contrivance, say an automatic block signal, to be reliable in an emergency, must be kept in daily use; but the Black automatic mechanical block signals, with which the Manhattan is equipped for several miles, are now used only in foggy weather, the apparatus being entirely disconnected from the track levers, and the semaphores left in the safety position, at all ordinary times. The trackmen have charge of the signals, and on the occurrence of a fog they at once reconnect all the rods and levers, an operation which is quickly performed, and the signals at once respond to the movements of the trains. These men act under well-defined rules, which have been in force for many years, the track force acting as 'fogmen" to give hand signals on those parts of the road where there are no automatic signals. The Manhattan has one piece of track (along the west side of Central Park) which is subject to very dense fogs and its men have to be as fully prepared for emergencies of this kind as do those on the railroads in and around London. From midnight to about 4½ o'clock in the morning the trains run fifteen minutes apart and for these hours the trackmen relax their vigilance, the trains being run, in case of fog, under the old rules. In fact it would, during that time, be perfectly feasible to run the trains by the absolute block system as in the fifteen minute interval a train will pass several telegraph stations. As is well known, the Black signal is a small semaphore, the arm of which is moved directly by the power furnished by the pressure of the wheels on a lever fixed alongside the rail, the signal being returned to the all-clear position by a similar movement conveyed from the outgoing back to the incoming end of the block section (1,700 ft.) by means of a gas-pipe rod similar to that used in ordinary interlocking switch connections. There are two very good reasons why the Manhattan should adopt this practice. First, its line is mostly straight and the speed of its trains is moderate, so that in clear weather trains can be run very close together, there being no danger in this except the liability of an engineman to miscalculate the distance within which he can stop his train, a danger which experience has shown to be exceedingly remote; and, the business being heavy, this close running is necessary, and a fixed space interval is often a hindrance. This delay is the direct reason for the disuse of the signals, but the second reason, wear and tear, is important. On the Sixth Avenue line there are over 200 trains each way daily, even on the upper and thinner part of the line, and the unnecessary destruction of apparatus during clear weather would amount in the long run to a very considerable sum. The Manhattan's experience with the Black signals has now extended over several years and they have an excellent record for reliability.

We have received from the Statistician's Office of the Inter-state Commerce Commission the form of Annual Report for 1892, and the pamphlet giving the classification of operating expenses. So far as we can see or learn, there has been very little change made from the form of 1891. The progress toward uniformity appears to continue, as the Commission has furnished state editions of this same form for Alabama, Connecticut, Iowa, Maine, Minnesota, North Carolina, North Dakota, Ohio, Texas and Virginia. It is understood by the National Commission that nearly all of the states use annual report forms similar to this. The reader undoubtedly knows the great amount of labor thrown upon the accounting departments of railroads by the requirements of these reports. The sub-division of expenses is most minute, and the effort is continued to distribute expenses between passenger and freight service; where no better distribution is possible, it is to be made by train mileage. We find, for instance, in looking over the pages of "operating expenses" in the form of report, that there are 46 different items, each one of which must be divided between the different classes of traffic. Under "maintenance of way and structures" there are nine items, these being repairs of roadway, renewals of rails, renewals of ties and so on through the items of bridges, fences, buildings docks and telegraph. Under "conducting transportation," there are fifteen items. These sub-divide the wages among enginemen, firemen, roundhouse men, as one class; trainmen as another; switchmen, flagmen and watchmen as another; train dispatchers and operators as another, and station agents, clerks and laborers as still another class. With all our respect for statistics and statisticians, it is hard to imagine what good this minute sub-division in reporting to the Commission is doing; and it is likely that neither the railroads nor the public will long endure the burden of labor and expense thrown upon the railroads and upon the taxpayers, unless they see some results. The latest statistical tables which we have from the Interstate Commerce Commission are those for the year ending June 30, 1889. Advance sheets of the introduction to the statistician's report for 1890 were received some months ago, but the tables, as we say, have not reached us. We are, therefore, over three years behind in these statistics. Now, it is possible that somebody is getting some good from all the labor that the Commission performs in its own offices, and for that which it throws upon the railroads, but it requires a good deal of faith to believe it.

In the last issue of the *Technograph* is an article by E. S. Keene, describing some experiments made to determine the relative efficiency of different cutting angles in lathe tools. The apparatus used was a spring dynamometer attached to the face plate of a lathe. This dynamometer consists mainly in two blocks screwed into the face plate, the left hand block having one end of a spring coil fastened to it. A pin, parallel to the axis of the spring, passed freely through the holes in both blocks so as to receive the thrusts of the dog driving the piece operated upon. This pin in turn compressed the spring. A roll of paper on which the diagrams were traced was driven by a screw and wheel motion operated by a belt and pulleys back of the face plate. Two pencils were used on the diagram paper, one to mark a datum and the other registering the resistance of the piece in cutting. For measuring angles of rake or inclination of the different surfaces, a beveled protractor was used and the angles were measured from the vertical and horizontal plane of the tool. The angle of the forward inclination of the tool is called "clearance," and that of the side of the tool is called the "side rake," and the angle made by the upper cutting face of the diamond point is called a "top rake." The experiments were conducted with tools known as the diamond points. The angles of the "top rake" ranged from zero to 20 degrees; the "side rake" from 25 degrees to 10 degrees. With tools of 25 degrees side rake, the average increase in efficiency of cutting for each five degrees of top rake was 18 73 per cent. With 20 degrees side rake the increase was 23.8 per cent.; and with 10 degrees the increase was 38.63. For all the experiments without regard to the "side rake," the average increase in cutting value for each degree of "top rake" was 21.6 per cent.

The Engineer (London) has dropped into acknowledged fiction and begun the publication of a continued story, "The Captain of the 'Mary Rose,' a Tale of To-Morrow," by Mr. W. Laird Cowles. The story looks attractive. It is illustrated by some excellent drawings, and by some of the impudent sort; that is, those that are affected by the "impressionist" school and in which delirium tremens stands for art. The editor says that the story is told with a purpose, and if the purpose is judiciously concealed under the proper amount of good narrative, probably no one will object to it. The purpose is to put in a strong light the future methods of naval warfare, so that they will appeal at once to the reason and to the imagination, and certainly this purpose is a worthy and ambitious one. What folks do not know about the next great naval war is a good many times as great as what they do know, and we anticipate reading with much pleasure Mr. Cowles' effort to "lift the veil of the future" as the reporters say.

The wheat crop prospects, judging from the best opinions that we can gather, are for something more than an average crop, but, of course, very much smaller than last year's crop. The production for 1891 was about 612,000,000 bushels. Good judges put the crop of 1892 at from 480,000,000 to 520,000,000 bushels. The crop for the 12 years from 1879 to 1890 inclusive averaged 446¼ million bushels, the range having been from 383 to 512. The condition of both spring and winter wheat has been, from the opening of the growing season, much less favorable than last year. The probabilities are, also, that Europe and India will fall below last year in production, and that consequently the demand for wheat from the United States will be good.

Some weeks ago we spoke of the fact that the Pennsylvania had run a freight train from Chicago to Philadelphia with one engine. A distance of 824 miles was traversed by this train, during which time the locomotive was not once uncoupled from the train. The total length of the train was 1,602 ft., and it carried 2,640,000 lbs. of grain, an average of 66,000 lbs. to each car. The locomotive and cars were equipped throughout with Westinghouse brakes. The engine was No. 263 standard class "R." The locomotive and tender weighed 188,500 lbs. The forty 34-ft. box cars with loads weighed 3,824,000 lbs., and the caboose 18,000 lbs., the total weight of train being 4,030,500 lbs.

Gross earnings for July and for the year to July 31, are reported as usual by the *Chronicle* and *Bradstreet's*. The gain for the month was $1,049,345, or 2.34 per cent. over last year by one journal, and 3.4 by the other. The comparison is with a very prosperous month and the conditions were not favorable. Wheat and corn shipments have fallen off, and cotton receipts were slightly less. Probably the Homestead troubles have had some effect also, but that is not enough to change the aggregate materially, for the shipments of manufactured iron and steel have continued active. For the seven months the gain in gross was 7.1 per cent., against 5.0 last year and 11.0 in 1890.

NEW PUBLICATIONS.

*Railroad Track.** By A. Haarmann, General Superintendent of the Georgs-Marien Iron Works & Mining Co., Osnabrück. Historical Part, two volumes quarto. XL. + 852 pages, with index and 1,837 wood cuts in the text. Leipsic: Wilhelm Englemann, 1891. Price $10.

In our issue of Jan. 8 last, we published a review by Dr. Wedding of this really monumental work. This review was in the form of a paper read by Dr. Wedding before the Verein für Eisenbahnkunde, the work having been undertaken under the auspices, or at least at the instigation, of that society. Dr. Wedding spoke of it as by far the most exhaustive contribution ever made to the literature of this subject. The volumes which have now been before us some months, confirm Dr. Wedding's estimate. Certainly, nothing at all approaching this book has ever been produced in the same field of study; and before we pass on to a consideration of the author's work, we may say that, mechanically, the book is in every way worthy of the ambitious scheme which Mr. Haarman has laid out. The paper and print are above criticism and the numerous wood cuts are excellently made. The index, too, is something worth imitating; 24 pages are given to it, and there is besides a synoptical table of contents of seven pages.

This "Historical Portion," which is all that has been published, and possibly all that ever will be published, is divided into three parts, the first of which is called a "general history of railroad track;' the second, "special history of track systems," and the third a "history of track construction."

The "general history" begins (as we should expect from a German scholar) with Babylon, but we discover no illustrations of track systems of that period. We do find, however, examples of Roman road going back to the beginning of the Christian era. Naturally such examples are few, and the history is rapidly brought down to two centuries ago, when we find examples of wooden track for carts, and numerous illustrations are given of the earliest forms of tramway track and of the railroad tracks of the first quarter of this century. The next topic taken up in the general historical portion is that of rails; this is followed by ties of wood, stone and iron. A chapter on rail fastenings follows, and another one on track joints, and the first part closes with a chapter on switches.

The second part, on the "special history of track systems," treats of the topics of wooden ties under the heads of blocks, longitudinals and crossties; of stone blocks and of iron longitudinals and crossties. The third part, "history of track construction," has chapters on gauge, on the establishment of the line, treating of curves and grades; on road bed; on tracklaying, maintenance and repairs.

The author has gone over the whole field of literature, and his illustrations and descriptions are drawn from technical journals, the files of which have become inaccessible to most people, from pamphlets and books, old and new, as well as from museums and actual examples on the ground. He has used American authorities very freely, quoting from the *Railroad Gazette*, *Engineering News*, Parson's "Track," Ringwalt's "Transportation Systems," and Colburn & Holley's "Permanent Way." The *Transactions* of the American Society of Civil Engineers have also been drawn upon freely. The result is, that the American reader will recognize a great deal that he is very familiar with; on the other hand, he will see a great many things that will be novel to him, and we would especially advise inventors of compound rails, of rail joints, of track fastening, and of metal ties, to get and carefully study these exhaustive pages. Even if they do not read German, the very numerous and beautiful illustrations will be full of instruction for them, and many a man will save a great deal more than $10 worth of time, if he will condescend to look carefully through these volumes and begin his inventions where other men have left off.

The mere recital of the titles of the chapters gives no notion of the fullness with which each topic is treated.

*Das Eisenbahn-Geleise. Von A. Haarmann, General Director des Georgs-Marien-Bergwerks und Hütten Vereins.

The best practice of all lands and of all periods of railroad building is given, and the illustrations bear not only the names of the railroads from which they are drawn, but the dates of their use, so that from the engravings alone one can trace very completely the development of the vast subject in its details. We have suggested the value of the work to all who have to study designs of rails, rail fastenings, joints and ties. It is also a cyclopedia for those who have to build and maintain roadbed. Many examples are given of the best standards of formation and ballast, and these include old and recent American standards, as well as European. In brief, the great value of the work, and it is very great, comes as much from the author's liberal breadth of view as from his laborious thoroughness and accuracy. Taken all through, considering the information collected and the way of presenting it, this is a remarkably sound job of bookmaking.

TRADE CATALOGUES.

Steam Hot Blast Apparatus for Heating and Ventilating. Huyett & Smith Manufacturing Co, Detroit, Mich.

The mechanical method of heating and ventilating which is described has been successfully applied to many large buildings, including theatres, factories and machine shops, among others the Metropolitan Opera House in St. Paul, Minn.; C. Aultman & Co.'s shops at Canton, O., the greatest manufacturers of threshing machines and engines in the world; the shops of the Wrought Iron Bridge Co., Canton, O., and shops of the Chicago & Grand Trunk and of the Pennsylvania have been equipped with this system. The method is by the plenum system, and great economy is claimed, besides positive results.

Bolt Heading, Upsetting, Forging and Bending Machinery. The National Machinery Co., Tiffin, O.

Several of the machines shown by the National Co. are illustrated in perspective and also in line. They include machines which have been standard for many years, and while the company claims no originality for its great line of standard machinery it does claim to have simplified and improved in details many of the tools which it manufactures.

Grant's Gear Book for 1892. Lexington Gear Works of Lexington, Mass. This pamphlet is handy for anyone desiring cut gears, as it gives much valuable information on the subject of gears and gear cutting, and also gives some wholesome advice to those who, when ordering gears, do not give sufficient description of what they want. There is also a short dissertation on the subject of laying out gears.

Engines and Boilers. Bay State Iron Works, Erie, Pa.—The stationary and portable engines and boilers for a considerable variety of uses which are shown in this catalogue have long been known to users. In addition to them several special tools are shown, such as a power punch, a steam crane, etc.

Irrigation and Water Storage in the Arid Regions.

"The opinion obtains among many that the rainfall of the arid regions is typically represented by the California rainfall, with a wet season from November to March, and a practically, if not totally, rainless season for the rest of the year. . . . This peculiar distribution of rainfall, however, is not characteristic of the entire arid region, and it obtains definitely only in California (with slight exceptions) and a portion of Nevada. . . . It will appear clearly from the curves (of precipitation, that the varying periods of *wet* and *dry*, or *very wet* and *very dry* months are almost as many in number as the states to which they obtain. These curves also make it apparent that in order to insure in the arid regions economic and successful crops by irrigation, the growth of only such crops should be attempted or encouraged in different sections as are suited to the character of the local soil, the varying local seasonal temperatures, and which by their seasonal period of germination and development would have the advantage of the rainfall of those months in which the greater part of the general precipitation occurs." In these words Gen. A. W. Greely in effect replies to a large number of people who have been proposing expenditure of public money in carrying out vast irrigation schemes before even the elements of the problem have been ascertained.

In a document prepared by Lieut. W. A. Glassford, with an introductory epitome by General Greely, and issued as Executive Document No. 287, House of Representatives, is collected an immense mass of statistics upon the climatology of the arid regions, with especial reference to irrigation, together with many maps showing lines of equal precipitation, temperature and evaporation, and a report explanatory of the causes for the observed peculiarities of climate, besides other conditions which must be met in the reclamation of these regions.

The states and territories of Arizona, California, Colorado, Nevada, New Mexico and Utah, comprise in their limits those sections of the United States over which the rainfall is the smallest, the prevailing temperatures the highest, the evaporation of moisture most decided, and the amount of sunlight the greatest. These conditions do not apply to the whole of the arid region, however, since variations occur which might often be misleading unless carefully studied. For example, the absolute annual precipitation of some districts is as high as in other more favored portions of the United States. The rainfall at Julian, San Diego County, Cal., averages 37.08 inches, which is practically identical with that of Pittsburgh, Pa. (36.71 inches). The comparative effectiveness of these rainfalls for industrial purposes is shown by the distribution by months:

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Length of record.
Julian	4.81	3.25	9.85	5.98	0.73	0.09	0.00	0.00	0.00	0.55	2.23	5.28	6 yrs.
Pittsburgh	3.21	2.62	2 85	2 61	3.07	3.59	4.90	3.45	2.53	2.49	2.58	2.75	19 yrs.

Conditions the reverse of these are by no means uncommon. Nebraska and large parts of Kansas and South Dakota, with an annual rainfall one-half that of Virginia, Maryland and Delaware, have three-fifths of their rainfall during the months of April, May, June and July, which gives them a productivity very nearly approaching that of the Eastern states mentioned. In the arid regions the distribution of rainfall is not so fortunate, being in general reduced to almost nothing during May, June and July. It is evident, therefore, that the impounded waters for irrigation must be held for long periods, in some cases as long as six and seven months, which must cause enormous losses by seepage and evaporation.

The latter question has been very carefully studied, and the conclusion is reached that if freely exposed the amount of water which would be evaporated in the arid regions would be equal to a depth of from 6 to 9 ft., and in some cases 15 ft. Prof. Gilbert has estimated that the evaporation from Great Salt Lake amounts to 6 ft. 6 in. annually, which agrees very closely with the values determined by the Signal Service for that region with the aid of evaporometers.

Lieut. Glassford has suggested a possible check for the losses which would occur by evaporation from reservoirs in the introduction of the Utricularia, or Bladderwort, which grows at the bottom of bodies of still water until it has reached a length of three or four inches, when the bladders on the root fill with air and float the plant to the surface where its fine and closely matted leaves form a thick covering of green protecting the water to a large extent from the action of sun and wind. Concerning the possibility that it might interfere with the flow in ditches it is noted that in England ponds completely covered with Utricularia have their outlets kept perfectly free by a current of less than two furlongs an hour.

The annual rainfall in the arid regions is far below the possible evaporation, being for Arizona 12.42 in.; for California, 22.56 in.; for Colorado, 12.61 in.; for Nevada, 10.64 in.; for New Mexico, 13.62 in., and for Utah, 10.32 in.; but the manner of this precipitation, being usually in sudden showers of great intensity, is peculiarly favorable, enabling a larger catchment to be made than would be possible if light showers were the rule.

The precipitation recorded by the signal service, furthermore, does not represent the total, since the observation stations are all situated down in the valleys, while frequent and heavy showers prevail at nearly all seasons upon the summits of the mountains which do not extend to the lower country, but whose effect is noticed in the swelling of the streams to torrents.

In the depressed basins and valleys of New Mexico, and in the San Simon and sulphur valleys in Arizona the existence of subterranean water has been proven, and both here and in many instances where surface waters are used, elevation of water will be necessary. The power to do this seems to exist with a fair degree of reliability in the prevalent winds, whose hourly velocities throughout the year have been made a matter of record. From these it appears that the average hourly velocity for the arid region diminishes from a maximum of 7 to 10 miles in the spring months to a minimum of 5 to 7 miles in the late summer and fall months. As a velocity of 4 miles is sufficient for effective work by the highest class of wind engines, the evidence on this point is encouraging.

Lieut. Glassford thus summarizes the deductions for Arizona:

"1. Twice each year there occurs sufficient aqueous precipitation to reclaim every acre of land worthy of such reclamation.

"2. The coefficient of evaporation, though absolutely high, is yet relatively so small in comparison with the total fluid contents of the actual and projected storage basins that it may be economically disregarded as a vanishing quantity.

"3. A measureless amount of foot-pounds of available power is daily going to waste in the winds which blow over the land."

There are already under irrigation 566,460 acres in Arizona, and 639,055 acres in New Mexico, which represents only a small fraction of the irrigable lands available. Much of this land was once under cultivation, with the aid of irrigation, by the prehistoric races of America, as is proved by the remains of their ditches, many of which were made of masonry, and are being used to-day by the Mormons in the Salt River Valley. Near Florence, Ariz., which contains the famous Casa Grande Ruins, are found old irrigating ditches choked in places by streams of lava. Excavations made through these rocky barriers have disclosed the old cement beds of the aqueducts intact below.

TECHNICAL.

Manufacturing and Business.

Messrs. Edward Kendall & Sons, of Cambridgeport, Mass., have delivered a Belpaire boiler for the New Bedford Water Works similar to those of the Newtown Water Works, which were illustrated in the *Railroad Gazette* of July 15. These boilers are designed by Mr. F. W. Dean, and the one recently delivered to New Bedford is to carry 160 lbs. of steam.

The Union Switch & Signal Co. has begun the erection of an addition to its machine shops, Swissvale, Pa.

The Barney & Smith Car Co. has declared a dividend of 2 per cent. on its preferred stock, payable Sept. 1.

Tenders will be received by the Canadian Pacific up to Sept. 1 for 2,050,000 tamarack cross ties, to be delivered along the line of the road between Fort William and Brandon, Man.

The equipment which the large contractors own is not very generally known. The Drake & Stratton Co. (Limited) owns and operates 14 locomotives, 10 steam shovels, six Lidgerwood rapid unloaders, a new device for unloading flat cars of gravel or ballast, 12 ballast plows, 300 platform cars, 44 Lidgerwood standard hoisting engines, besides a large array of boilers, pumps, horse-power derricks, boats, rock drills, horses and wagons, small tools, etc. The firm has offices in New York, Philadelphia and Pittsburgh.

The Coe Brass Mfg. Co. is again making additions to its extensive plant at Thompsonville, Conn., and has placed the contract with the Berlin Iron Bridge Co., of East Berlin, Conn., for three iron buildings, one 32x130 ft., another 50x50 ft., and the third 60x160 ft.

New Stations and Shops.

The Philadelphia & Reading has completed its new repair shops at Wayne Junction, Pa., destroyed by fire last March. The structure is 400 ft. long and 475 ft. wide. The side walls are of brick and the roof is of iron.

Native American Cement in Building Foundations. The Chicago agents of the Utica Cement Association, of La Salle, Ill., recently invited the engineers, architects and building contractors of Chicago to visit the works of the Illinois Steel Co., at South Chicago, to inspect the foundations of a new boiler and ship plate mill now being erected. The foundations are built entirely with Utica (native Illinois) cement and broken slag. The foundations rest upon the sand which underlies the whole plant. No piling or other supports are employed to give stability to the foundations. Foundations of this nature were built at these mills some time ago, using this cement, and have not yet shown weakness. The cement and slag are mixed in a mechanical mixer and carted in wheelbarrows to the foundation molds where it is dumped and tamped.

Upon these foundations are built piers of brick laid in cement for supporting the heavy engines and rolling machinery. The usual practice when building foundations for heavy machinery of the nature used here is to go down to hard pan and build foundations of masonry laid in Portland cement. The serviceability of the native cement has been demonstrated by its use in the foundations of these mills, where it has given entire satisfaction. When building a temporary track for delivering materials near the foundations, it was necessary to cut away about two feet of one of the completed piers, and it was found that the cement had set very hard.

The Santa Anna Cable Road at Genoa.

Genoa, Italy, now also has an inclined cable railroad which was given over to regular traffic a short time ago. The track is laid on a masonry viaduct, about 20 ft. wide, and motive power is furnished by water ballast. The rails and crossties, as well as the safety rack which is used to engage with a brake pinion on the cars, are of steel. The road is known as the Santa Anna road, and is of a single track type, with a turnout midway between the two terminals. The total length of the line, measured on the incline, is about 1,182 ft., the difference in elevation between the terminals being about 184 ft. The grade ranges from 14 to 19½ per cent. The cars are designed to seat 16 passengers, and to accommodate 40 as a maximum. The steel cable measures about 1 in. in diameter, and has a factor of safety of 10. Each car has both hand and automatic brakes, the latter coming into action in case of cable rupture.

The Pennsylvania Double Deck Ferry Service.

It is well known that the Pennsylvania road has had several ferry boats built with two decks for the service between Jersey City and New York, and that it is intended to allow passengers to go from the trains arriving in the Jersey City train house, to the east side of West street in New York before descending to the street level. The ferry slips have been arranged with double deck bridges in order to carry out this scheme, and it is said that these bridges are now ready for service. A bridge over West street was built some months ago. The upper bridge in the ferry slip is hung from a shaft by chains, and is adjustable in height like the usual form of ferry bridge. It is provided also with a hinged apron, which will rest on the upper deck of the ferry boat. The departure is an interesting one, and it may be sufficiently

popular with passengers to gradually lead other railroad companies to adopt the same plan. Certainly the numerous suburban passengers using these ferries will be glad of any relief from the present inconvenience of crossing West street.

The Hudson River Tunnel.

The Hudson River Tunnel Co. held a meeting in London Aug. 11. Mr. J. Kendall, who presided, informed the meeting that owing to the default in interest it is advisable to protect the bondholders by electing a trustee. The company is without money; even its solicitors are unpaid. Mr. Golding explained the steps that are being taken to reconstitute the company in New York. Sir Benjamin Baker gave a detailed account of the status of the work. He said there remained only 1,884 ft. to complete the tunnel. Lord Brabourne and Messrs. Ruegg and Golding were appointed a committee to name a trustee.

Compound Locomotives on the Long Island Railroad.

We have before now mentioned the fact that the Long Island Railroad Co. is using 10 suburban compounds of the Vauclain type, which are nearly identical with those of the Chicago elevated, but have 20-in. stroke instead of 16 in., 51-in. wheels instead of 42 in. and weigh 34 tons instead of 28. We are informed that they have given no trouble, except that they do not steam as freely as they might, but it is thought that this defect will be overcome very soon. A comparative test of one of these engines with a simple engine running in like service and doing the same work shows an average fuel economy of 17½ per cent. in favor of the compound.

Pintsch Gas in India.

The first-class carriage of the Madras Railway sent to Bombay to be fitted up with the Pintsch gas lighting apparatus, was returned to Madras in June. The carriage which was thus experimentally lighted had only one lamp in each compartment; but when the gas-lighting is introduced each compartment will be fitted up with two lamps. There will be a reservoir under each carriage holding sufficient gas to burn for 36 hours continuously—in the experimental carriage there are two reservoirs, one on each side, containing sufficient gas to burn for 72 hours, owing to the reservoirs having at present to be charged at Bombay. The lamps are fitted with an arrangement by which the guard can, after the passengers have retired for the night, by pulling the handle of a sliding bar reduce the flame to a glimmer. The lamps are lighted from the roof, the lighting arrangement being inaccessible to the passengers.

New Steamers on the Great Lakes.

The Northern Steamship Co. has let a contract for the building of two large lake steamships to the Globe Iron Works of Cleveland. These steamships are to make the run between Duluth and Buffalo in 50 hours without stopping. The company has five vessels now running between these points, but they all call at Cleveland, making the time longer than necessary. It is stated that these will be the largest, finest and most speedy boats on the lakes, and that the cost of each will be not far from $400,000.

Photography in Surveying.

This is the subject of an illustrated article by Vincenz Pollack, Chief Engineer of the Austrian government railroads, in the *Schweizerische Bauzeitung* of July 9, 1892. He thinks photography particularly useful in minimizing the amount of field work necessary, and in dealing with objects or territory difficult or impossible of access. The methods were first laid down by Laussedal, at Paris, and Von Meydenbauer, at Berlin, and while their use has been growing but slowly, their merits have already met with extensive recognition. They are said to have rendered particularly good services on the Austrian government railroads in 1888 in the prosecution of glacier studies. Mr. Pollack's article gives illustrations of the apparatus and diagrams and explanations of the method of using it.

Grade Indicators.

A French exchange describes an apparatus which has been introduced to some extent to indicate the grade over which a locomotive is passing at any instant. A horizontal tube four or five metres long is fastened longitudinally to the locomotive, and bent at each end to a vertical branch. The position of a fluid in the branch at the driver's end indicates the grade. It is stated that this is accurate to within one per cent.

Crematories for the Disposal of Garbage in Chicago.

The disposal of garbage and animal refuse in the city of Chicago has become a very serious question. Various methods have been tried and abandoned owing to their being a menace to the public health. A few months ago the Health Department began experimenting with garbage cremation. An experimental plant was built and was quite successful. The city authorities seem to be satisfied that this method is the best for the city of Chicago. Acting upon this the Council has passed an ordinance (July 18) calling for the erection of several trial garbage crematories to be built upon the banks or near the Chicago River. At first it was understood that the city would furnish the sites for the plants; but when the proposals for the bids were advertised, the conditions were that the bidders were to furnish the ground and erect the plant, and the city would furnish refuse and garbage not to exceed sixty tons daily. This refuse is to be furnished free of cost to the crematory during the time of a test, which will not exceed three months. Owing to the high values of real estate in localities suitable for such plants, it is quite probable that some of the crematory patentees and owners will be unable to make bids. The sites that it was supposed the city would furnish were at the street ends abutting the river. Bidders are required to state in their bids the daily capacity in tons, fitness and capacity to destroy garbage mixed with ashes, price per ton for refuse cremated, time necessary to build the plant and put it into operation, price at which the plant will be sold to the city inside of twelve months from date of completion, and the price for one or more crematories in other localities to be designated by the mayor of the city. The bids were opened this week.

The Hill Curved Spike.

Our readers were made familiar some time ago, through description and illustration in the *Railroad Gazette*, with the curved spike designed and patented by Mr. S. C. Hill. It was shown in our issue of Aug. 8, 1890, and for months in our advertising pages. It will doubtless be remembered that the spike is made with a continuous curve on the inside. In driving the point is started a little away from the flange of the rail. The theory is that when the curved part of the spike begins to bear against the flange the point will take an outward path and the spike will be kept in close contact with the flange. The consequence is that up to the last blow there is a firm bearing of the spike against the flange, and the spike is in position to resist direct pulling much better than the ordinary spike. These claims were borne out by a number of tests that were made. The spike was put in the hands of the C. H. Dunham Railway Equipment Co., but owing to the failure of that company it has not been on the market for something more than a year. The inventor and owner of the patent, Mr. Hill, has now made contracts with the Tudor Iron Works, of St. Louis, and the Tredegar Works, of Richmond, giving them the exclusive right to manufacture and sell in the United States and Canada. Probably it will be pushed now with such energy that its real merits will soon be a matter of actual demonstration.

The Jones Adjustable Metallic Weather Strip.

This weather strip, for which Horace N. Loomis, of Hightstown, N. J., is agent, consists of a strip of spring brass bent to a trough shape and beaded on one edge. The thin edge is let into a groove in the face of the sash, where it is held by screws. The other side extends down the edge of the sash, acting as a spring to hold it in place, preventing rattling and thoroughly excluding the dust, besides permitting the window to be easily raised and lowered, thus doing away with the disagreeable sticking tendencies of the ordinary arrangements. The weather strip has been in use on Pullman cars for the past two years, and is being tried by the Jones Car Co. and the Gilbert Car Co., Troy, N. Y., the Lamokin Car Co., Chester, Pa., and the Combination Car Co., Waltham, Mass.

Special World's Fair Cars.

A special car for World's Fair passenger business has been designed at the Columbus shops of the Pennsylvania lines, and it is said that 100 of them are to be built there. These will be built on the frames of standard 34 ft. gondolas, and after the special occasion for their use is passed they can be cheaply converted for freight service. They are to have wide windows and comfortable seats, and will be used only for comparatively short runs, say of 100 miles. Naturally with freight car trucks they will not be as comfortable to ride in as regular passenger cars, but for short runs they will probably be found satisfactory. The Illinois Central is working on the same lines to help out its emergency passenger equipment.

Committee on Steel Centre Sills, Master Car Builders' Association.

The Secretary of the Master Car Builders' Association has announced the following committee to consider and report whether the use of steel centre sills in freight cars would be desirable: D. L. Barnes, J. N. Barr and J. D. McElwain.

Eucalyptus for Locomotive Boilers.

Some discussion took place last year on the value of Eucalyptus fluid as a disincrustator for locomotive boilers. It is interesting to note that extensive trials have been made with the fluid on the Eastern Bengal State Railway, the preparation being manufactured on the spot from leaves obtained from the Saharanpur botanical gardens. On the whole, the result has been very satisfactory. Eucalyptus, it is reported, has the effect of gradually softening the scale which forms on the barrel, tubes and fire-box, and the deposit can be scraped and washed off without difficulty. Attempts have been made to grow the plant on the lands of the North-Western Railway, but hitherto without success.—*Indian Engineer.*

THE SCRAP HEAP.

Notes.

The Coosa Mountain Tunnel, on the Columbus & Western, which was obstructed by fire three months ago, is now being lined with brick, and it is expected that the road will be opened through it about Sept. 1.

The State Railroad Commissioners of Oregon have notified the Union Pacific that the Board will require the company to put an additional brakeman on its passenger trains between Portland and Huntington, the trains now being run with only one.

The station and office building of the New Orleans, Fort Jackson & Grand Isle road, at Algiers, La., opposite New Orleans, was destroyed last week by the caving in of the bank of the Mississippi River where the station stood. The loss to the railroad is above $30,000.

The Grade Crossing Commissioners of Buffalo have examined the Coroner's records and find that Jan. 1, 1890, 64 persons have been killed at railroad crossings in that city. The total number of deaths from injuries on railroad premises in the city was about three times this number.

The Mississippi state railroad commission has sent notices to the Pullman Palace Car Co., the Western Union Telegraph Co., and the United States Express Co., calling on them to show cause why the penalty of $5,000 should not be imposed for failing to report their property for taxation.

Some of the inconveniences of railroading in the lower Mississippi Valley are suggested by the announcement last week that the trains of the Illinois Central out of New Orleans will hereafter start 30 minutes later on account of the relief from high water and the consequent improvement of the roadbed.

The Ottawa *Evening Journal* reported on August 12 that an Order in Council had been passed and forwarded to the Governor-General for his signature, abolishing the rebate in canal tolls. It appears, however, that this is simply a decision not to abolish the discriminating rebates this season, and a very conditional promise to do so next winter. In the meantime the two governments are to get together and agree upon some sort of a compromise if possible, which shall finally dispose of all occasions for dispute.

The stockade at Tracy City, Tenn., in which the convicts employed by the Tennessee Coal, Iron & Railroad Company were confined, was burned on Aug. 13, by a mob of miners. The property of the company was first removed, and the convicts, 350 in number, were led out under guard and locked up in freight cars. The stockade buildings were destroyed and the convicts sent to Nashville, where they were transferred to the penitentiary. On the way the train broke in two and a number made a break for liberty. Two were shot and killed by the guards and six or eight made their escape. On Monday a similar outrage was committed at Inman, Tenn., though without violence.

Spanish-American Notes.

Mr. H. G. Cabrett has been appointed Assistant General Manager of the Central Argentine Railroad.

The extension of the Central Argentine Railroad from Coronel Zelaya to Capilla del Señor was opened to traffic on July 1st.

Mr. Carl Plock has been appointed Director General of the Gran Ferrocarril de Venezuela, with headquarters at Caracas.

Tenders for repairs and extension of the mole at Ilo, Peru, will be solicited in a few days by the Department of Public Works.

The São Paulo Railroad is again blocked with an excess of freight, and for two weeks declined to forward goods delivered to it from the Mogyana Railroad.

The Sorocabana and the Ituana railroads, Brazil, having consolidated, the new company will henceforth be known as the Companhia União Sorocabana & Ituana.

Military Rolling Stock.

The possibility of being obliged to move large bodies of troops and much military material is always before the Indian administrations, and constant progress is being made throughout India in fitting rolling stock for such purposes. On the Great Indian Peninsula Railway alone nearly 3,000 open freight cars have been adapted for the carriage of light guns and 50 for heavy pieces. About 1,500 covered freight cars are arranged for carrying horses, and a considerable number of passenger vehicles have been fitted with ambulance appliances. The transport of elephants is also being provided for. Two trucks have been fitted up for this purpose on the North-Western Railway, and experiments have been made by the military authorities to determine the suitability of the vehicles for this purpose. In the trials the trucks were found to be somewhat unstable for their load, and in future they will be weighted to insure greater steadiness.

Electric Street Roads.

The Washington & Great Falls Electric road, recently chartered, is to extend parallel to the conduit road along the north bank of the Potomac River, a distance of 16 miles. The trolley system is authorized. The conduit road is the great driving boulevard of the District of Columbia, along which is situated the palisades of the Potomac, Cabin John Bridge, the great Falls of the Potomac, etc. The road will be a double track, and the Washington terminal will have elevated tracks a distance of 3,000 ft. Stock and bonds of the road to be determined by the Supreme Court of the District of Columbia, not to exceed $1,000,000, and are to be limited to the actual cost of the road and its equipment. The stock books will be opened Aug. 23 at the office of the Washington & Chesapeake Beach Railroad, Washington Loan & Trust Co. Building, Washington, D. C. T. W. Tyrer is the Secretary.

Sullivan's Striking Energy.

A mechanical engineer has taken the trouble to reduce to accurate figures certain deductions from a recent experiment in measuring the velocity of a blow delivered by that gentleman from Boston whom the New York *Sun* calls John Lawrence Sullivan. The velocity was determined by an electrical recording apparatus, described in a recent issue of the *Sun*, and Mr. John Thomson analyses the record in the following letter to the *Sun*. We suggest that Mr. Thomason also has overlooked one element. John's arm is not all that is concerned. A certain part of the weight of his body should be added to the assumed weight of the moving parts, for his whole flexible and ponderous torso goes forward when he swings his "terrible right." Still, 457 foot pounds is enough for most of us.

"Your account states that after the bag had been struck by Sullivan, it travelled 15¾ in. in 0.0875. This equals an average rate of one inch in a trifle over 0.00365 a second. Divide one second by the latter amount, and we find that, if the motion had been uniformly continued 274 in., or 22.85 ft., would have been traversed in one second of time; while in an hour, 156 miles would have been reeled off, and to say that the Philadelphia express trains would 'not be in it,' is well within the truth.

"But the most impressive example of all is yet to come. Assume the weight of the Bean Man's mighty 'duke' and forearm—the members moving under high velocity—as equal to, say, 20 pounds, or about one-tenth of his entire weight, and then multipiy the velocity in feet per second by the weight of the moving mass, and the product will be the striking energy in foot pounds—457 pounds (in avoirdupois, of course, not Troy), or the measure of the loving pressure with which that 'terrible right' will impinge on the too, too snifty nose of an opponent, provided, however, that it 'lands.'

"In the experiment there seems to have been but one feature overlooked, and why so important an element was neglected can probably only be explained because of the tremulous excitement over the success of the first—the velocity of his 'handy left' does not seem to have been recorded. JOHN THOMSON."

Tracks and Interlocking at World's Fair Grounds.

In the *Railroad Gazette* of May 27 we gave a description and a plan of the arrangements of the various railroad interests centred at Jackson Park. As intimated in that article, the Lake Shore & Michigan Southern and Pennsylvania lines were unable to secure the terminals at the southeast corner of the grounds, and they will consequently enter at the southwest corner with the Illinois Central and the Baltimore & Ohio. The plan of the station and terminals as shown in the *Railroad Gazette* of that date is practically correct except that the Elevated Railroad has a four-track terminal above the transportation annex instead of five tracks as shown. The main terminal station will have 12 double tracks, with a third or switching track between each pair for running the engines around the trains. Each train will have the same engine in and out of the station. Each track will hold a train of 10 cars or more. Twenty-four trains can be handled simultaneously; or, at a careful calculation, at least 15,000 passengers can be taken out of or brought into the station every 10 minutes.

The switches will be signaled and interlocked by the Wuerpel system of interlocking, the Wuerpel Switch & Signal Co., of St. Louis, having been awarded the contract last week.

Broad Street Station, Philadelphia.

The architects of the new addition to the Broad Street station of the Pennsylvania Railroad, at Philadelphia, Furness & Evans, 209 South Third street, Philadelphia, are now at work on the details of the building. The plans for the new trainshed have been finally adopted and A. & P. Roberts & Co., 261 South Fourth street, Philadelphia, have been awarded the contract for the iron work. The receiving freight offices on the north side of Market street, between Fifteenth and Sixteenth streets, are being torn down ready for the erection of the new trainshed. Nearly all the buildings on the north side of Market streets, between Sixteenth and Eighteenth streets, are being torn down and the scene is one of great activity. P. McManus has been awarded the contract for the masonry work for the widening of the elevated railroad west from Fifteenth street, and the brick piers for the arches are now well under way. The Adams Express building now situated at the northwest corner of Sixteenth and Market streets is to be torn down and removed to the northeast corner of Seventeenth and Market streets. The contract for this work has been let to Jacob R. Garber, 52 North Thirteenth street. The work is to be completed in 75 working days from the commencement of the work, under a penalty of $100 a day for each day beyond that limit, and if the work is completed inside of the 75 days the contractor is to receive a bonus of $100 for every day less than that time.

A New Natural Gas Pipe Line.

A pipe line is being built by the Columbus Construction Co. from the gas fields of Central Indiana to Chicago. It has been completed as far as the Illinois state line.

The Union Pacific Telegraphers.

The Union Pacific avoided a strike (on Aug. 6) by one minute. Just before 6 o'clock the demands of the telegraph operators for higher wages were granted. The point at issue was comparatively a small one. Of the 885 telegraphers on the Union Pacific system 114 receive salaries less than $50 a month. The Grievance Committee demand that $50 shall be the minimum on all divisions. . . . On certain poor branches, the Kansas Central, the Lincoln & Colorado, the Omaha & Republican Valley and the line from Leavenworth to Lawrence, there are two operators at $30 a month and a number at $35. The company offered to make the maximum on these $45 and agreed to the rest of the schedule. The difference between the two propositions was about $3,000. On the Santa Fe, the Union Pacific's chief rival, the average rate of operators' pay is only $54.40 a month, while on the Union Pacific it is $61.70. On the Santa Fe the largest class at one rate is the $45 men, who number 121. In the Union Pacific the $60 men are the most numerous, there being 121 of them. The telegraphers have accepted $45 as the minimum on the Santa Fe, but insist on $50 on the Union Pacific. [This they secured.] —*St. Louis Republic.*

An Old Overshot Water Wheel.

On old-time overshot water wheel, which had been in constant use for the past 54 years, and which has just been relegated to the scrap heap, is illustrated and briefly described in a recent issue of the *Schweizerische Bauzeitung*. The wheel was built in 1837 at St. Georgen, Switzerland. It transmitted its power through gear teeth at its outer periphery, being built up to 40 segments, having 19 teeth each. The diameter of the wheel was 57½ ft. At its circumference the wheel increased 5 ft. in width; near the shaft 10 ft. 4 in. It was designed to work under a head of 59 ft. The wheel was probably the last surviving representative of the large overshot type in Switzerland.

The Invention of the Steam Locomotive Engine.

Lord Kelvin, in unveiling the bust of William Murdoch at the Abbey Craig Monument, said that Murdoch invented the locomotive steam engine. He made an engine 20 in. long by 14 in. high, put a high-pressure steam boiler on it, and began driving it on a road in Redruth, where he was then living. It had this effect. The locomotive ran off from its inventor, on a gloomy, cloudy night, at the rate of six to eight miles an hour. It soon outran the inventor, and then the night air was rent by a succession of frightened cries for help. Murdoch, hurrying up, found the worthy rector, who heard a puffing and snorting and saw only a fiery eye rushing along not much above the level of the ground. He would not say what the rector thought he saw. After that Murdoch went about from mine to mine on a steam locomotive of his own construction, and it seemed to Lord Kelvin very much because there were so many objections to his idea that he did not anticipate George Stephenson by at least twenty or thirty years in the great work he had done for the world.—*Engineering.*

An Old Story Retold.

The railroads and State Tax Commissioners are having a warm time over the assessments of taxes. If some of the statements made by representatives of the iron highways are true, it will not be long before a majority of the railroad corporations will be in the hands of a receiver. It is represented that the common carriers are operated by philanthropists, whose sole desire is to benefit the public. The meeting of the Commissioners develops the further fact that the physical condition of Indiana railroads is deplorable.—*Indianapolis Dispatch.*

Aluminum Car Window Frames.

One of the latest practical applications of aluminum is found in its use in making railroad car window frames. Such aluminum window frames, according to the Austrian *Eisenbahn-Zeitung*, are now made at Neuhausen, Switzerland, by the Schweizerische Industrie-Gesellschaft. Extreme lightness, naturally, is the main feature of the frames.

The Chicago Stock Yards.

The agreement by which the Chicago Junction Railways and the Union Stock Yards Co. bought off the rival concern which Armour, Swift, Morris and others threatened to establish near Hammond, Ind., has just been consummated, the dilatory suits entered by dissatisfied stockholders having been decided in favor of the defendants.

The Chicago Junction Railways & Union Stock Yards Co., incorporated in New Jersey two years ago, is the successor of the old Union Stock Yards Co. About that time the packers above named, who are the heaviest customers of the stock yards, started their scheme for an independent yard, their alleged reason being the exorbitant prices charged at the Union yard. The contract under which they were finally induced to abandon their plans was made in July, 1891, and by it they agree to remain customers of the Union yards for 15 years. In consideration they receive stock in the Union Co. variously stated as from $2,000,000 to $5,000,000. It is said that the total stock of the Union Co. is now $20,000,000. The decisions just rendered were made by Vice-Chancellors Van Fleet and Green, of New Jersey, the suits having been entered in New Jersey courts.

LOCOMOTIVE BUILDING.

The Richmond Locomotive Works are building two large locomotives for the South Bound road.

The Duluth, Mesaba & Northern has purchased from the New York Equipment Co. six standard engines.

The Great Northern has received from the Baldwin Locomotive Works five freight and two passenger Vauclain compounds.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered from the Rhode Island Locomotive Works two heavy compounds and two switching engines.

A new observation engine for the use of General Superintendent Voorhees, of the New York Central & Hudson River road, has been recently turned out of the West Albany shops.

The Illinois Central has invited bids for the construction of two new compound suburban locomotives of the Forney type, having 18x24 in. cylinders and six coupled drivers, two-wheeled leading truck, and four-wheeled tender truck, similar to the Wootten Vauclain compound, illustrated in the *Railroad Gazette*, April 1, 1892.

CAR BUILDING.

The Brainerd & Northern Minnesota has ordered 125 logging cars from the Russell Wheel & Foundry Co., of Detroit, Mich.

The Wisconsin Central is in the market for 30 passenger cars. Six new sleepers will also be added to the company's equipment.

The Houston & Texas Central has received 125 platform cars and is having 275 cars additional built to complete an order for 400 cars.

BRIDGE BUILDING.

Cambridge, Md.—Bids for widening the draw in the bridge over Cambridge Creek to 60 ft. have been received at the county commissioners' office from the King Bridge Co., John Demithorne & Son, E. A. Perkins & Co., H. A. Lachicotte, Toledo Bridge Co., Pennsylvania Bridge Co., Pittsburgh Bridge Co. Massillon Bridge Co., Dean & Westbrook and the variety Iron Works Co. The plans and bids have been submitted to H. C. Latrobe, C. E., of Baltimore, for examination and report.

Chicago.—The Cook County Board of Trustees will erect a new drawbridge over the Calumet River. Plans have been prepared by R. J. Marshon.

Cuero, Tex.—The county court will at once let the contract for a bridge across the Guadalupe River between Hockheim and Yoakum.

Cumberland, Md.—The new double track bridge which crosses Will's creek at the George's creek railroad crossing has been completed. The bridge was built by the Pennsylvania Steel Co., and is composed of two spans 90 and 94 ft. in length.

Louisville, Ky.—The Mayor has approved the ordinance for a viaduct to cost $50,000 over Kentucky avenue.

Milwaukee, Wis.—The Finance Committee of the Common Council has instructed the City Attorney to draft ordinances for the issue of $300,000 of bridge and viaduct bonds.

Mount Vernon, Wash.—The Board of County Commissioners has let a contract to Westerman & Yenton, of Seattle, for the construction of a wagon bridge across the river at this place, to cost $29,000.

Palmer, Mass.—The Boston & Albany is to build two new highway bridges about one mile east of the station, a special commission having just apportioned the expenses between the railroad, the town and the State, under the Massachusetts law. The first bridge is overhead and the next one, about 100 rods further east, known as Blanchard's Crossing, is to be an under bridge.

Port Elgin, Ont.—The contract for the new steel bridge over Mill Creek was let last week to the Central Bridge Works, Peterboro. The bridge will consist of one span of 172 ft. and will cost about $5,000.

Portland, Or.—Plans and specifications have been submitted to the Supervisors for a bridge over the railroad track at Arlington street, and it is estimated that it will cost $3,000.

Providence, R. I.—The Common Councils have appropriated $70,000 to provide for the construction of a new bridge at Washington street. The bridge will have a total length of 132½ ft., and will consist of four spans supported on masonry piers.

Rochester, N. Y.—The Common Council has passed a resolution for the construction of a stone arch bridge at Andrews street.

Saginaw, Mich.—The Flint & Pere Marquette has in contemplation the construction of a viaduct on North Washington avenue over its tracks at that point.

Thompsonville, Conn.—The Suffield & Thompsonville Bridge Co., lately organized at Thompsonville, called for plans and estimates for a bridge over the Connecticut River, 1,060 ft. long. Sixty-nine bids were received from 14 bridge companies, and, after careful consideration, acting on the advice of their engineer, Mr. E. S. Shaw, of Boston, the company has placed the contract for the bridge with the Berlin Iron Bridge Co. It will consist of five spans of 210 ft. each, with a roadway 20 ft. wide in the clear, and will cost $60,000.

Wilmington, Del.—The Levy Court of New Castle County has decided to build a bridge across the Brandywine river at Washington street. Plans will be prepared by Alvin R. Morrison, of the Delaware Construction Co.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Maine, semi-annual, $3 per share on the preferred stock, payable Sept. 1.

Chicago & West Michigan, semi-annual, 1½ per cent., payable Aug. 15.

Chicago, Burlington & Quincy, quarterly, 1¼ per cent., payable Sept. 15.

Cleveland & Pittsburgh, quarterly, 1¾ per cent. on the guaranteed stock, payable Sept. 1.

Maine Central, semi-annual, $3 per share, payable Aug. 15.

North Pennsylvania, quarterly, 2 per cent., payable Aug. 25.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago, Milwaukee & St. Paul, annual, Milwaukee, Wis., Sept. 21.

Richmond & West Point Terminal, special, Richmond, Va., Sept. 15, for the election of directors.

St. Louis Southern, annual, Pinckneyville, Ill., Sept. 6.

Toledo & Ohio Central, annual, Toledo, O., Sept. 5.

Wabash, annual, St. Louis, Mo., Sept. 13.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y. The next meeting will be Sept. 15.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-

monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Engineers and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The Association of Engineers of Virginia.

A meeting of the society has been called for October 21 and 22 at the city of Roanoke, Va. The subject for discussion is the improvement of the common roads of the state, and papers are asked on this topic from engineers, whether members of the society or not.

The Board of Directors have authorized the publishing of the second volume of the proceedings of the Association. This volume will contain the papers read at both the January and July meetings and will also contain the new constitution and rules, together with a list of its members. J. R. Schick is Secretary.

PERSONAL.

—Mr. W. L. Pierce, Secretary of the Lidgerwood Mfg. Co., sailed last week on the "Teutonic" for Europe. Mr. Pierce goes abroad both for pleasure and business, and will not return until Oct. 1.

—Mr. A. E. De Ricqles has been appointed General Manager of the Union stock yards recently established at Salt Lake City, and also General Agent of the Union Pacific and Rio Grande Western.

—Mr. C. A. Cairns, Assistant General Agent of the Chicago & Great Western, has resigned that position and has accepted a position in the passenger department of the Chicago & Northwestern road.

—Mr. J. H. Van Tassell, Superintendent of the Ohio Southern for a number of years, resigned this week, and has been succeeded by Mr. William Ramsey, a brother of Mr. J. Ramsey, jr., General Manager of the Cleveland, Cincinnati, Chicago & St. Louis.

—Mr. Daniel M. Zimmerman, formerly Secretary and Treasurer of the Camden & Atlantic road, died this week in Switzerland of heart failure. In 1871 he was elected Secretary and Treasurer of the Camden & Atlantic road, which position he resigned in 1890 to travel in Europe for his health.

—Prof. Charles W. Scribner, of Cornell University, has accepted the chair of mechanical engineering at the University of Illinois. In 1867 Professor Scribner was called to the chair of mechanical engineering in the Iowa State College at Ames. This place he held for four years. Last year he resigned his position at Ames to pursue an advanced course of study in engineering at Cornell University.

—Messrs Theodore Cooper and William R. Hutton, of New York, and George H. Rice, Chief Engineer of the Boston Rapid Transit Commission, made an inspection of the Baltimore Belt Railroad tunnel last week, in company with Vice-President Thomas M. King, of the Baltimore & Ohio, who is the managing director of the Belt road; William T. Manning, Acting Chief Engineer of the Baltimore & Ohio; Major Richard Randolph, Chief Engineer of the Maryland Construction Co., and Henry Reid, Engineer for Ryan & McDonald.

—Mr. Lloyd Tevis, who has been President of Wells, Fargo & Co. for 15 years, has retired from the management of that company to devote his entire attention to his personal affairs. During his presidency the capital stock of the company was increased from $500,000 to $6,500,000, and dividends were paid amounting to $9,000,000. The directors have elected as his successor Mr. John J. Valentine, for 10 years Vice-President and General Manager of the company. They have also elected Mr. W. F. Goad, Chairman of the Finance Committee, First Vice-President, and Colonel Dudley Evans, Second Vice-President.

—Mr. Hugh Riddle, Chairman of the Executive Committee of the Chicago, Rock Island & Pacific, and ex-President of that company, died at his home in Chicago, Aug. 11, of heart disease. He was exactly 70 years of age, having been born on Aug. 11, 1822, at Bedford, N. Y. At the age of 20 he became a member of the engineer corps of the Erie road, and from 1851 to 1869 he was identified with the operating department of that system. In the latter year he came to Chicago as General Superintendent of the Rock Island road. In 1871 he became Vice-President of that company, and in 1877 he was elected President, serving in that capacity until 1883. He was elected a director of the Union Pacific in 1885.

—Mr. Benjamin G. Clarke, the President of the Thomas Iron Co., died in Antwerp, Belgium, this week. Mr. Clarke was born in Easton, Penn., about 72 years ago, and early in life began his business career in the iron and steel trade. He was one of the founders of the Thomas Iron Co., at Hokendauqua, Penn. He was elected President of the company several years ago. In addition to his connection with the Thomas Iron Co. and the Lackawana Iron & Steel Co., Mr. Clarke was also director of and had a large interest in the Lackawanna Iron & Coal Co., the Delaware, Lackawanna & Western Railroad, the Tilly Foster Iron Co., the Hudson River Ore & Iron Co., the New Jersey Zinc & Iron Co. and other pipe, iron and steel companies. He was also president of the New Jersey Zinc & Iron Co.

—Col. H. C. Nutt, formerly President of the Atlantic & Pacific, died at his home at Brookline, Mass., Aug. 15, aged 59 years, after an illness of nearly four years of paralysis. His earliest railroad experience was in engineering parties of New England roads. From 1851 to 1855 Col. Nutt was Chief Engineer of Construction and Location of the Peoria & Oquawka road (now part of the Chicago, Burlington & Quincy), and from 1857 to 1860 was Chief Engineer of the Council Bluffs & St. Joseph road. In 1867 he entered into contracts for transferring freight over the Missouri River between Council Bluffs and Omaha, and continued in that business until the completion of the Union Pacific bridge in 1873. Later he engaged in the elevator business in Chicago and so continued till 1881, when he accepted the presidency of the Atlantic & Pacific. In consequence of ill health, Col. Nutt resigned the presidency of the company in 1889.

—Mr. Jabez A. Bostwick, formerly President of the New York & New England, died suddenly on Aug 24, at Mamaroneck, near New York. His death is attributed to heart disease and excitement while aiding to extinguish a fire on his property. Mr. Bostwick was prominent in railroad, financial and mercantile circles. He was born about 62 years ago, near Rome, N. Y., but his family removed to Ohio while was still a child. He entered business in New York as a cotton dealer, and later he embarked in the oil business as a refiner and buyer of crude oil, and after fighting the old Standard Oil Co. for some time, he projected and was one of the organizers of the Standard Oil Trust. He assumed entire control of the crude oil department of the Trust. He was President of the New York & New England for about five years, resigning last March in order that Austin Corbin might be elected. A few months ago he retired from the board of directors, having sold his stock. He also resigned from the Housatonic board of directors quite recently.

—Gen. William Pettit Trowbridge, the head of the engineering department of the School of Mines, Columbia College, died at his home in New Haven July 12. Professor Trowbridge was born in Troy, Oakland County, Mich., May 25, 1828, and was appointed a cadet at West Point in 1844, graduated at the head of his class, and became a second lieutenant in the Corps of Engineers. His scientific attainments were already recognized, and from 1852 to 1856 he was engaged on the coast survey under Alexander D. Bache, subsequently taking part in the survey of the Appomattax and James rivers, and in conducting a series of surveys on the Pacific Coast, extending from San Diego to Puget Sound. In 1854 Professor Trowbridge was promoted to be First Lieutenant, but resigned on Dec. 1, 1856, to accept the chair of Professor of Mathematics in the University of Michigan, which he held for a year and resigned to accept the office of Scientific Secretary of the Superintendent of the United States Coast Survey. At the beginning of the war of the Rebellion General Trowbridge joined the army again and served to the end of the war in and about New York. From 1865 to 1869 he was the Vice-President of the Novelty Iron Works in New York, and was elected Professor of Dynamic Engineering in the Sheffield Scientific School at Yale, resigning in 1877 to become Professor of Engineering at Columbia, which position he held at the time of his death. He was connected with various public works, and wrote several scientific books; among them is "Heat as a Source of Power." He received the degree of A. M. from Rochester University in 1856, and from Yale in 1870; the degree of Ph. D. from Trinity College in 1883, and from Michigan University in 1887. He was the chief agent of the tenth census for collecting statistics relating to power and machinery employed in manufactures.

ELECTIONS AND APPOINTMENTS.

Addison & Pennsylvania.—The directors of the reorganized company are: Thomas C. Platt, William Brookfield, Frank H. Platt, Frank R. Winn, Walter G. Oakman, William C. Sheldon, jr., and Randolph Rodman, of New York City; Frank B. Platt, of Oswego, N. Y.; James E. Jones, of Nepra Park, N. Y.; Charles E. Jefferies, of Brooklyn; Henry R. Sloat, of Sloatsburg, N. Y.; Calvin S. Brice, of Lima, O.; and Augustus C. Gurnee, of Eden, Me.

Atlanta & Florida.—The stockholders of the road met at Atlanta, Ga., Aug. 10, and elected the following new board of directors: E. W. Marsh, L. H. Hill, W. J. Ashford, Willis Ragan, J. K. Brunner, C. A. Collier, C. E. Currier, C. F. Blalock, A. C. Harris, Z. B. Cole, B. B. Crew and R. M. Maddox. J. V. Moody was made Secretary of the company.

Atlanta & West Point.—At the annual meeting last week the following directors were elected: C. H. Phinizy, President. Directors: D. U. Speer, T. L. Langston, E. P. Chamberlain, Atlanta; H. M. Comer, Savannah; W. B. Berry and H. C. Fisher, Newman, Ga.

Chicago Great Western.—W. C. Rinearson has been appointed General Traveling Passenger Agent of the road, with headquarters in Chicago. Mr. Rinearson was formerly General Passenger Agent of the Erie system, and for the last year he has been the Chicago Great Western representative at Cincinnati.

Chicago & Northwestern.—B. H. Bannet, for several years connected with the passenger department of the Grand Trunk, has been appointed Canadian Passenger Agent of this road, with headquarters at Toronto.

Cleveland, Cincinnati, Chicago & St. Louis.—The general offices of the Cincinnati division have been removed from Springfield, O., to Cincinnati.

Coal River.—The stockholders of the company met this week and elected as Directors: John Byrne, of Brooklyn, N. Y.; R. H. Chew, of Charlestown, W. Va.; I. L. Cochran, of Charlottesville, Va.; Thomas L. Brown, R. T. Ohley, W. M. Peyton, and Fontaine Brown, of Charlestown, W. Va., and Roman Pickets, of Rome W. Va. Thomas L. Brown was elected President, R. T. Ohley Treasurer, and W. M. Peyton Secretary.

Crystal River.—The directors of this new Colorado company are J. S. Osgood, J. A. Kebler, C. H. Toll, Henry R. Wolcott, Dennis Sullivan, D. C. Beaman and Paul Morton.

Green Bay, St. Paul & Minneapolis.—The following is a corrected list of incorporators: Joseph Walker, Jr., of New York, A. Fell, Buffalo, N. Y., S. W. Champion, W. A. Abrams, F. B. Seymour, Green Bay, Wis.

Konkapot Valley.—This company, which was incorporated some time ago in Massachusetts, has organized with H. H. Laughaar, President; H. D. Sisson, Clerk, and A. F. Campbell, Treasurer.

Lehigh Valley.—James Cunningham has been appointed Master Mechanic of the Buffalo division.

Louisville, New Orleans & Texas.—W. D. Hurlbut has been appointed Assistant General Freight Agent of the railroad, with headquarters at Memphis, Tenn. Mr. Hurlout at present is Assistant General Freight Agent of the Illinois Central, and has his office in Chicago.

Mount Holly and Burlington Connecting.—The incorporators are: W. H. Clough, of New York City; George Norris, of Jersey City, and C. H. Gachel, of Philadelphia.

Nampa Railway & Construction Co.—Pringle C. Jones, of South Charleston, O., has been elected President; R. W. Purdun, of Nampa, Ida., Secretary, and T. D. Babbett, of Nampa, Chief Engineer.

New Boston.—These directors were elected last week: George A. Wason and James P. Whipple of New Boston, N. H., Frederick Smyth and Walter M. Parker, of Manchester, N. H., Benjamin A. Kimball and John H. Pearson, of Concord, N. H., and Charles A. Busiel of Laconia. George A. Wason was chosen President of the board, and E. H. Wason, clerk.

Philadelphia & New England.—The following are named as Directors of the Pennsylvania Division: Stephen Holmes, E. A. Bell, Stroudsburg, Pa.; Wm. H. Tinsman, Phillipsburgh, N. J.; A. D. Brown, Henry B. Wells and H. Van Etten, Milford; J. Ottenheimer, New York City; T. A. Shinn, Coolbaugh, Pa.; Benj. Ryall, Peter E. Parnum and O. P. Howell, Port Jervis. Stephen Holmes is President and E. A. Bell Secretary and Treasurer of the new company.

San Francisco & Santa Clara Valley.—This company, recently chartered in California, has elected the following directors: C. P. Harnes, P. J. Dunne, William R. A. Johnson, William P. Henley and James Deitrich, all of San Francisco. P. J. Dunne is treasurer. The office is in the Mills Building, San Francisco.

Toledo & Ohio Central.—M. W. Cooley, formerly connected with the Lake Shore & Michigan Southern, has assumed the position as Engineer of Maintenance of Way in the employ of this company, with headquarters at Bucyrus, O. J. W. Landgraf has been acting Secretary and Treasurer until a successor to John F. Cline, resigned, has been appointed, which will probably not be done until late in September.

RAILROAD CONSTRUCTION.
Incorporations, Surveys, Etc.

Abingdon Coal & Iron.—The grading has been completed on the section between Abingdon and Damascus, Va., 15 miles. Surveys are now being made for a line to Mountain City, Tenn.

Altoona, Clearfield & Northern.—McGovern Bros., of Tyrone, Pa., have the contract for an extension of this line, 1½ miles long. The road was commenced Aug. 15, and will involve 10,000 cubic yards of excavating. An elevated terminal is to be built in Altoona, Pa., at a cost of $10,000.

Astoria & Portland.—A recent report states that 12 miles of grading from a mile west of the south fork of the Lewis and Clarke River, conecting at the west end of the old Astoria & South Coast grade, has been completed, and also the tunnel at the headwaters of that river. The grading for the entire distance to the tunnel, 30 miles, will be completed by Sept. 1. Not much work could be done during the rainy season, but the grading is now being pushed. Work will soon be begun at the Hillsboro end of the road. Corey Bros., of Ogden, Utah, have about 1,200 men at work.

Atlanta & Florida.—The directors are considering a proposition to extend the road to some point on the Savannah, Americus & Montgomery road. They say that the road will certainly be extended, but to what points they have not yet decided. The extension from Fort Valley south to the Savannah, Americus & Montgomery would be nearly 40 miles long.

Brainerd & Northern Minnesota.—The first 40 miles of this road, now being built, is to be completed by Oct. 1st. On that date regular passenger and freight service will be inaugurated. Next year the road will be extended 75 miles further toward the international boundary. The preliminary survey extends in a general north and northwestern direction to Red Lake, passing near Leech Lake and touching Turtle and other smaller lakes. Surveys have also been made for branches to Park Rapids and to Leech Lake. Tracklaying was begun on Aug 10. The road is being built by the Northern Milling Co., of Minneapolis, and will reach white pine timber lands owned by the company. There is also good farming land in the section through which it passes.

Canadian Pacific.—Contracts have been let for the grading of the southern extension of this company's Souris branch from Estevan, Man., in a southeasterly direction to the international boundary, a distance of 25 miles. Also for the northwest extension of the Souris branch from Estevan to a junction with the main line near Pasqua, Man., east of Moose Jaw. Nothing but the grading will be done this season; the grading is ordinary prairie work with the exception of a little heavy work at the crossing of the Souris River.

Canadian Western.—The route of this road, it is announced, will be from Victoria, B. C., north to Seymour Narrows, and will follow on the mainland the old route of the Canadian Pacific to the eastern boundary of the province. The line has already been subsidized 20,000 acres a mile by the provincial government and Victoria. It is claimed that all arrangements for building the road have been completed by the construction company.

Chicago, Rock Island & Pacific.—All the right of way has been finally acquired after long negotiations for a new line through Lincoln, Neb. The new right of way through that city is from the point where the track now

crosses the Fremont, Elkhorn & Missouri Valley and the Burlington & Missouri River road, near the north limit of the city, passing through the east part of the town and to a connection with the Union Pacific, about four miles south of the town. The object is to avoid the long detour round the west side of the city through land which every spring is under water. The company will build a passenger depot on O street near Nineteenth street, and a freight house on R street near Eighteenth street, and will also build yards. The grading will be commenced this week. The new cut-off avoids five grade crossings of other roads.

Crystal River.—This company was incorporated in Colorado last week by Paul Morton, of Chicago, H. R. Walcott, of Denver, and other directors of the Colorado Fuel Co. The company has been organized to construct a series of branch roads in Garfield, Gunnison, Mesa and Delta counties. A new coal and coke field will be opened by these lines. The main line will either connect with the Denver & Rio Grande at Carbondale, or with the Colorado Midland near Sands Station and will extend thence up the Crystal River to the town of Elko in Gunnison County. There will be branches from Carbondale to Glenwood Springs and Grand Junction; from the confluence of the South Cannon Creek with Grand River, running up the creek to its source; from Newcastle west, etc. All the surveys have been made, and work on the road will be started immediately. A great part of the country through which the line runs is practically undeveloped.

Duluth, Mississippi River & Northern.—Grading is well under way on this road, which is to extend from the Mississippi River, in the central portion of Aitkin County, Minn., northeasterly, crossing the Duluth & Winnipeg road, to Rainey River. The route extends through a large timber tract and reaches the western end of the Mesaba iron range, and also touches the Vermillion range. The company expects to have 30 miles in operation this fall. The contractors are Grant, Foley Bros. & Guthrie, of St. Paul, Minn.

Everett & Monte Christo.—Earle & Donohue, the contractors for the heavy work in the canyon on this road, east of Everett, Wash., state that the 800-ft. tunnel has been bored about 450 ft., and will be completed by October. On the 530-ft. tunnel the work at one end has been stopped.

Great Northern.—The extension from Pacific Junction has been opened for traffic to Spokane, Wash., 512 miles in length, the first through passenger train leaving St. Paul on the evening of Aug. 14. There are 60 new stations on the extension. The opening of this brings the total mileage of the Great Northern system up to 3,921 miles.

Great Salt Lake & Hot Springs.—The charter of the company was amended last week, authorizing the extension from Salt Lake City west to the Nevada state line, about 140 miles, described last week.

Green Bay, St. Paul & Minneapolis.—The engineers are now working on the surveys for the road, which has just been chartered to build an extension of the Green Bay, Winona & St. Paul to St. Paul and Minneapolis. The new road will be about 120 miles long and when completed the distance from Green Bay to St. Paul will be 388 miles. The officers state that the work will begin as soon as the route has been determined. If the right of way is secured without delay and the construction is not otherwise hindered, they expect to have a considerable part of the work completed this year. The directors are given in another column. Edward Sargent is Chief Engineer.

Illinois & Iowa Terminal.—Chief Engineer Baker's report of the survey from Davenport to Moline, Ia., gives the distance from the proposed terminus opposite Moline and Clinton as 28 miles, and the cost of the road is estimated at $338,000 and $387,000 for grading and tracklaying.

Indiana, Illinois & Iowa.—A stockholder's meeting has been called to act upon the proposed extension from Knox eastward to South Bend, Ind. The preliminary survey has been recently made. It is intended that bonds amounting to $400,000 shall be issued for the above purpose. The work on the extension will begin in September if the stockholders ratify the propositions of the directors.

Jacksonville, St. Augustine & Halifax River.—The extension which is now being built south of Daytona, Fla., is to be continued to Rockledge, Fla., a distance of 70 miles. Thirty miles have been graded ready for the ties, and the track is now being laid between Daytona and New Smyrna. Grading has also been begun between New Smyrna and Titusville, and between Titusville and Rockledge the grading is about half finished. About 1,500 men are working on the road at present. The contractors for grading are as follows: L. McLain, of Savannah. McLain & Brown, M. Hays & Son, J. Stewart, S. J. Fox, M. Healey and Paddison & Harden. The road passes through Port Orange, New Smyrna, Hawks Park, City Point, Cocoa, Titusville and Coquina. The work is light, the grades being 52.8 ft. to the mile, and the curves four degrees. The work is to be finished by Dec. 1 and the road will be in operation by Jan. 1, forming a new through line from Jacksonville to Rockledge in competition with the Jacksonville, Tampa & Key West. C. O. Haines is Chief Engineer.

Lake Erie & Detroit River.—This company is inviting tenders for the grading, etc., for the extension from Merlin, Ont., east 12 miles. The work will be devided into four sections, each three miles in length, the first two sections to be completed by Oct. 1 and the remaining two sections before Oct. 15, 1892. The right of way is being secured to Ridgetown.

McKeesport & Wilmerding.—This company, capital stock $100,000, has been granted a charter in Pennsylvania. The road will be 3½ miles in length, and will extend from the borough of McKeesport to Wall Street, near the extreme line of the borough of Wilmerding. A. W. Smith is President.

Mexican Southern.—Track has been laid to kilometre 73, from Tecomavaca, Mex., leaving but 44 miles to build before reaching Oaxaca. In this distance there is but one bridge of any importance to construct, the remainder of the work being tracklaying. The line will be completed to Oaxaca by Oct. 15, probably.

Montpelier & Chicago.—Contractors on the new Wabash extension from Montpelier to Chicago reached the new town of Ashley, Ind., last week, with the end of the track. Ashley will be the divisional terminal point on the new line, where the Wabash Company will locate yards, roundhouse, shops, etc.

Mount Holly & Burlington Connecting.—This company has been organized at Mount Holly, N. J., with a capital of $100,000, half of which has already been subscribed, to build a road from Mount Holly. The motive power is to be either steam or electricity.

New Roads.—Considerable interest is being taken in the proposed vote of $300,000 bonus from the City of Vancouver, B. C., toward building a road to connect with the Northern Pacific at the United States boundary.

A meeting was held last week at Marble Rock, Ia., in Floyd County, and upon the Burlington, Cedar Rapids & Northern, to take steps to build a road from Marble Rock northeast to Charles City, the county seat, a distance of 12 miles.

Surveyors have been at work for some time on a new road from St. Paul to West Superior, Wis. The survey parallels the St. Paul & Duluth to Hinckley, where it crosses and runs between the Eastern Minnesota and St. Paul & Duluth to West Superior.

New York, New Haven & Hartford.—The double-tracking of the Shore Line division is being pushed rapidly. The work is now being carried on between East Haven, Conn., and Leete's Island. Five miles of this section will be in operation within the next 60 days, but the remainder will not be opened before next spring. Work is also being pushed on the four tracking of the New York division, near New Haven and west of New Rochelle.

Ohio River.—The company will have an independent entrance into Huntington, W. Va., this week, when the bridge over the Guyandotte River, three miles above the town, is completed. Track has already been laid to Kenova, where the Ohio River road will connect with the Norfolk & Western.

Ottawa & Gatineau Valley.—This company has a large number of men at present employed pushing forward the construction of the line northward from Farrelton, Que., so as to be ready for the shipment of freight over the line to the lumbering regions of the Gatineau River next month. Already the line is almost completed as far north as Stag Creek, 10 miles above the present terminus.

Owensboro & West Louisville.—This road has been surveyed from Owensboro through West Louisville to Beech Grove, Ky., a distance of 20 miles, and C. H. Dishman, of Nashville, has the contract to build the road. It will not be constructed this year, because the new Kentucky constitution nullified all charters of projected roads, and a general railroad law has not yet been passed. B. S. Triplett, of Owensboro, is one of the projectors.

Payette, Salubria & Northern.—This company has filed articles of incorporation in Idaho. The proposed road is to extend from Payette via Weiser to Salubria. The capital stock is $1,000,000. The incorporators are I. W. Hart, William Ireton, M. Sproat and J. H. Richards.

Pennsylvania.—It is not the intention of the company to complete the fifth track for the entire distance from Philadelphia to New York at the present time, as the newspapers have recently stated, but merely to build a fifth track in short sections of a mile or more from time to time, and in this way gradually complete the fifth track over the entire New York Division. Fifth track is now being laid from Holmesburg Junction to North Penn Junction, a distance of about seven miles, and from Germantown Junction to Ridge avenue Station, a distance of a mile and a half. At some few points short sections of sixth track are also being laid. All the new girder bridges spanning city streets are built for six tracks.

Philadelphia Belt Line.—The Board of Port Wardens have given the desired permission to the company to build its road the construction to be partially bulkhead, partially piles and partially solid work along the water front of Bridesburg outside of the low-water line, in the Twenty-fifth and Twenty-third Wards, Philadelphia.

Portland & Rochester.—It is not proposed to build any new second track on this road this year, and the newspaper reports to that effect are erroneous.

Roanoke, Fincastle & Clifton Forge.—About 75 men are at work grading the road between Fincastle and Cloverdale, Va., 11½ miles, and nearly all the grading has been completed. It is expected to be finished by Oct. 1. The road will open up the marble and stone quarries near Fincastle. The line will probably be extended to a point on the Chesapeake & Ohio, about 12 miles.

Rochester & Honeoye Valley.—The first passenger train over the new Honeoye Valley branch of the Lehigh Valley road, was sent over the road Aug. 9. Trains will begin to run regularly over the new branch on Sept. 1. It extends from a point on the Buffalo & Geneva, near Rushville, north to Rochester, N. Y.

Rock Island Belt.—A dispatch from Rock Island, Ill., states that a company has been formed with E. H. Guyer, Henry Carse, John Crubaugh, Otto Huber, J. W. Potter, H. M. Blanding, S. W. Earle, G. C. Craig, W. Roth, F. C. Dukman and F. Haas, as directors, to secure right of way into the center of Rock Island for railroad purposes.

San Francisco & Santa Clara Valley.—This company has just been chartered in California, and is to construct a standard gauge line, 80 miles long, from San Francisco to a point near Gilroy, through the counties of San Francisco, San Mateo and Santa Clara. Of the capital stock $80,000 has been subscribed.

Seaboard Air Line Belt.—The contractors have 600 men and about 400 teams at work on this belt road at Atlanta, Ga., which is to be completed by Oct. 28. The grading is heavy, and the maximum grade is 60 ft. and the maximum curvature five degrees. Two iron bridges are to be built of 100 ft. span each. The route is from a point on the Georgia, Carolina & Northern, called North Decatur, to a point on the Western & Atlantic, called Howells, Ga., passing under the Atlanta & Charlotte Air Line at Belt Junction, a distance of 8½ miles. O. L. Cloud, Atlanta, is Chief Engineer.

Springfield, Yellville & White River.—Grading is now in progress on this road north from Winnerva, Ark., and the work is to be commenced very soon on the northern section at Springfield, Mo. The tracklaying will probably be commenced in September. The road is being built by the Northern Central Construction Co. The town of Springfield, Mo., has undertaken to raise a subsidy of $100,000 to aid in building the road through the county, and to secure right of way to the Arkansas State line. E. H. Webster, of Kansas City, is President, and W. E. Winne, Vice-President.

Texas, Louisiana & Eastern.—J. A. Smyth, Secretary of the company, who has just returned from Chicago to Conroe, Tex., gives an account of the progress of the work, which we condense: This road has been graded east from Conroe for 18 miles within three miles of Cleveland, where it will connect with the Houston, East & West Texas. Work on these last three miles will be resumed at once. The road is to be standard gauge and 19 cars of rails are now delivered and 12 are on the way. Seven miles have already been laid and 12 more will be this month. It is expected that trains will be running to Cleveland by Sept. 1. Over this short stretch three bridges have been built, Peach creek, 492 ft.; Caney Creek, 512 ft.; San Jacinto River, 792 ft.

Troy & New England.—Chief Engineer John A. Yates, of the Raymond Construction Company, has commenced the survey of this proposed road through Troy, N. Y. It is said that the work will be begun within the city limits before Oct. 1.

Tuscarora Valley.—The route of this road referred to last week is from Port Royal, in Juniata County, southwest through Tuscarora Valley, on the north side of the mountains, to East Waterford, Pa., a distance of 15 miles. The road will be in operation in October.

Ulysses & Pine Creek.—A charter for this road was issued in Pennsylvania last week to build a line through Potter County. The capital stock is $65,000.

Victoria & Sidney.—This company now has three parties of surveyors in the field under Chief Engineer Gray, who are running three preliminary lines from Sidney and Victoria, B. C. As soon as the location is decided on the right of way work will be commenced. The officers state that laborers will be put at work on the clearing in September.

Washington & Columbia River.—Articles of incorporation of this company have been filed in Washington with Levi Ankeny, W. L. Tyler and F. W. Payne as incorporators. The capital stock is $3,000,000. The object is to build a road from Hunt's Junction to Puget Sound; also, to build a road from Pleasant View, the terminal of the Eureka branch of the Oregon & Washington Territory road to Riparia. The new corporation is understood to be a reincorporation of the Oregon & Washington Territory, which road it expects to acquire by purchase.

West Virginia Central & Pittsburgh.—Writing in reference to the recent report that surveys had been recently resumed on the line up the Tygarts Valley, an officer informs us that nothing has as yet been done on that survey this season. The contemplated line leads from Beverly, W. Va., up Tygarts Valley River to the head of it at Mingo, then, by the way of the head waters of Elk River, crossing over to the Greenbrier River and down that river to Washington, thence continuing in a southern direction to intersect with the Chesapeake & Ohio near the White Sulphur Springs. Much of this preliminary work was done some years ago. The company will place a small party in the field soon for the purpose of resurveying the pass from the head waters of Tygarts Valley River to Greenbrier River. That is all that will be done this season.

West Virginia & Madison.—This company has been chartered in West Virginia to build a road from St. Albans to a point in Boone County. The capital stock is $500,000. The incorporators are L. Kessler, J. H. Meaders, J. W. Topperg, E. W. Clark and E. C. Colcord, all of St. Albans, W. Va.

Whitefield & Jefferson.—The track has been laid on the Gorman and Berlin extension as far as the Androscoggin River, and the 400-ft. iron bridge is now being placed in position. As soon as this is completed the tracklaying on the balance of the road will be rapidly finished.

GENERAL RAILROAD NEWS.

Addison & Pennsylvania.—The purchasers of the road at the foreclosure sale in July filed a new charter in New York this week. The capital stock is $425,000.

Astoria & Portland.—The legal transfer of the old Astoria & South Coast road to this company, which has been operating the former line, was accomplished last week, when the Astoria & South Coast trustees were paid $58,000 in accordance with the agreement for the transfer.

Illinois Central.—The income from traffic for the twelve months ending June 30, 1892 and 1891, was as follows:

	1892.	1891.	Inc.
Miles operated	2,888	2,875	13
Gross earn	$19,291,700	$17,881,555	$1,410,205
Oper. Ex. and taxes	14,070,020	12,761,046	1,308,974
Net earn	$5,221,740	$5,120,509	$101,231

The gross receipts from traffic for July, 1892, are estimated at $1,468,390, and for July, 1891, the receipts were $1,501,866, the estimated, decrease being $33,476.

Kansas City, Wyandotte & Northwestern.—E. S. W. Drought, of Kansas City, Kan., has brought suit against the Northwestern Construction Co., to recover $350,000, a claim arising out of the construction of the road. A few months since, the company, by suit, compelled Jay Gould to comply with a contract made by him with the company to take construction bonds of the road worth $500,000, but the road has not yet been transferred by the construction company and this suit may prevent the transfer.

Minneapolis & St. Louis.—A committee was appointed last week to represent the stockholders in the pending suit for foreclosure brought in a Minnesota court by holders of $1,000,000 improvement and equipment mortgage bonds. The committee consists of Frederick P. Olcott, William A. Read, August Belmont, William L. Bull and J. Kennedy Tod. The committee has issued a circular reciting the present condition of the company's affairs, and the failure to reorganize the company, and adds that the primary object of the committee is to contest the foreclosure suits referred to. Upon their determination the next step will be conditioned. Should the court refuse to authorize a foreclosure of the mortgage, such decision would be an expression that the road is once more capable of meeting its fixed charges, and it is probable that a successful effort would then be made to raise the million or more dollars due on coupons in order that the receivership might be discharged.

New York & New England.—State Controller Staub, of Connecticut, has decided to reserve for the present his decision in the matter of registering $2,000,000 new issue five per cent. 20-year bonds of the road. He gives as his reason for not deciding the question

that injunction proceedings have been begun restraining the road from taking further action to secure the registration of any bonds.

Richmond & Danville.—Judge Bond, of the United States Circuit Court at Richmond, has made Messrs. Foster and Huidekoper permanent receivers of the company. The motion was opposed by counsel for the Richmond Terminal Company, acting under a resolution passed at the last meeting of the Richmond Terminal directors directing him to ask Judge Bond to postpone the hearing until after the stockholders' meeting called for Sept. 15.

Richmond & West Point Terminal Co.—Receiver Walter G. Oakman this week filed in the United States Circuit Court a report giving an inventory of the assets and an account of his expenditures. On June 22, when he was appointed, he found securities on hand to the amount of $74,632,369. Of this sum $17,296,900 was deposited under the six per cent. mortgage; $40,845,300 under the five per cent. mortgage; $495,000 was deposited to be exchanged for Richmond & Danville five per cent. bonds; $5,830,700 had been hypothecated by the Richmond & Danville road; $2,500,100 had been deposited under the preferred stock agreement; $180,000 had been hypothecated by the Terminal Company, and this left $7,484,869 on hand unpledged. In addition to this there are $2,423,935 of stocks and bonds paid in full. The property and bills receivable are valued at $1,506,943.

St. Paul & Duluth.—The company had on hand from sales of land and stumpage at the end of the last fiscal year, June 30, 1892, a net sum of $226,636. Under the plan of reorganization this is to be used in the purchase by the company of its preferred, stock and the Treasurer has asked for proposals for the sale of this stock.

Southern Central.—A bill of foreclosure has been filed in the New York Supreme Court by the Metropolitan Trust Co. against this road, the Lehigh Valley, the Pennsylvania & New York Canal & R. R. and the Philadelphia & Reading. The last three named are made defendants on the ground of having interests in the property of the road acquired subsequent to the execution of the mortgage. The amount of the mortgage is $3,400,000. The company defaulted in 1888 and issued a new bond for the accrued interest subsequently. The road extends from Lake Ontario to Owego and Waverly, N.Y., and is 140 miles in length. In 1886 a lease of the property was made to the Lehigh Valley. No interest has been paid on the consolidated bonds since the lease was made.

Union Pacific.—The following is the financial statement of the entire system and of various divisions for June and the six months to June 30:

UNION PACIFIC SYSTEM.

Month of June:	1892.	1891.	Inc. or dec.	
Mileage	8,148	8,144	I.	4
Gross earn	$3,920,413	$3,524,741	I.	$395,671
Net earn	1,661,218	1,128,321	I.	535,896
Six months:				
Gross earn	19,987,273	19,437,363	I.	549,909
Net earn	6,483,768	5,783,420	I.	700,348

UNION PACIFIC PROPER.

Month of June:				
Gross earn	$3,756,772	$3,447,785	I.	$308,987
Net earn	1,625,661	1,127,466	I.	498,195
Six months:				
Gross earn	19,077,516	18,915,805	I.	161,711
Net earn	6,210,600	5,766,773	I.	443,827

OREGON SHORT LINE.

Gross earn	$264,991	$263,395	I.	$2,599
Net earn	346,873	280,423	I.	66,449
Six months:				
Gross earn	$3,291,834	$3,702,180	D.	410,345
Net earn	1,211,118	1,404,108	D.	192,989

OREGON RAILWAY & NAVIGATION.

Gross earn	$111,673	$138,650	D.	$27,017
Net earn	165,725	122,860	I.	42,865
Six months:				
Gross earn	$1,960,474	$2,571,133	D.	$610,658
Net earn	356,386	718,521	D.	362,135

UNION PACIFIC, DENVER & GULF.

Gross earn	$519,032	$162 500	I.	$56,402
Net earn	155,475	89,490	I.	65,984
Six months:				
Gross earn	$2,719,919	$2,474,565	I.	$244,353
Net earn	539,778	463,058	I.	76,719

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, Aug. 17.

Rates to the seaboard are advanced to-day to 22½ cents per 100 lbs. on grain and its products and 25 cents per 100 lbs. on sixth class. The Michigan Central and the Lake Shore, however, have agreed with their eastern connections to make no advance on dressed meats to Albany and interior points in New York State. Lake and rail rates are advanced to the basis of 17½ cents from Chicago to New York.

The Atchison, Topeka & Santa Fe applied to the Chairman of the Western Passenger Association for authority to make a round trip rate of $5 from Chicago to Kansas City and return for the Knights of Pythias Encampment, beginning Aug. 23, claiming that its competitors are cutting the agreed rate of $10, and the application has been granted, to go into effect Aug. 20 and tickets to be good to return until Sept. 15, between Chicago, Kansas City, Atchison, St. Joseph and Leavenworth, with the same rate from St. Louis. In granting the application Chairman Caldwell states that he deeply regrets the course of action that has been forced upon him, but evidence before him leaves no doubt in his mind that the reduced rates quoted by the Atchison as being in effect have really been made.

The Chicago & Alton, with characteristic independence, takes advantage of this demoralization to reduce one-way tickets. Its reply to Mr. Caldwell's notice says: This company will sell tickets as follows: . . . Aug. 20 to 25, inclusive, Chicago to Kansas City, single trip, and St. Louis to Kansas City, single trip, $3, limited to date of sale. Aug. 20 to Sept. 5, inclusive, Chicago to Kansas City, single trip, $5, and St. Louis to Kansas City, single trip, $4, limited to date of sale. Aug. 20 to Sept. 10, inclusive, Kansas City to Chicago, single trip, $5; Kansas City to St. Louis, single trip, $4; limited to date of sale.

As noted in this column last week, the changes in the agreement of the Western Freight Association proposed by the Burlington failed of adoption, owing to the opposition of the Alton, Chicago & Great Western and Atchison companies. The two former companies were evidently opposed to any changes which would bring the agreement of the Western Freight Association more into conformity with the Western Traffic Association, of which they are not members, and the Atchison probably looked with some suspicion upon the amendments as proposed by the Burlington, in view of the notice given by that company of its proposed withdrawal from the Western Traffic Association. The report, however, that the Burlington is attempting to remodel the Western Freight with a view to its taking the place now held by the Western Traffic is all speculation, as there is no certainty as to what will be the outcome of the next meeting of the presidents.

All the other western lines will probably follow the example of the Fort Scott and Trans-Missouri lines and omit the signature clause from the tickets for the Grand Army excursion to Washington.

The latest move in the demoralization of eastbound passenger rates is the announcement by the Baltimore & Ohio of a round trip rate of $20.00 from Chicago to Atlantic City, Aug. 18, good for thirty days.

The "Soo" line is again cutting rates from Minneapolis, having issued a tariff naming a rate of 12½ cents on flour from Gladstone to New York, making a through rate of 22½ cents from Minneapolis. This will shut out the St. Paul-Chicago lines unless arrangements can be made with the lake and rail lines to join them in making the reduction. Efforts are being made, however, to get the "Soo" line to withdraw the tariff and restore rates.

The Southern Pacific has appealed to the Commissioners of the Western Traffic Association for authority to make a rate of 50 cents per 100 lbs. on canned goods, wine and borax from San Francisco to New York, Chicago, St. Louis and New Orleans, to meet the competition of the clippers around the Horn. For the same reason they also ask to be allowed to make reductions from New York to San Francisco on many commodities principally affected by this competition. They have also applied for reductions from Pacific Coast points to Colorado common points. All these appeals will be heard by the Commissioners to morrow.

The Northwestern roads have agreed to restore the lumber rates on Sept. 1 to those in effect prior to the three cent reduction from Eau Claire, which was ordered by the Interstate Commerce Commissioners a few weeks ago. This restoration is made on the ground that the reduction will not benefit Eau Claire, as the relative differentials are preserved by all lines and the only result would be great demoralization and loss of revenue. It is reported to-day that the "Soo" line will restore flour rates to Boston at the request of its Eastern connections.

The Missouri River packers have for a long time been contending that they are being discriminated against in the matter of rates on packing house products to the Pacific Coast. Recently one of the Missouri River lines made application in the Trans-Continental Association for a change in the adjustment of these rates whereby the rate from the Mississippi River should be advanced 5 cents, and that from Chicago and common points 10 cents. There was opposition to this from the Chicago lines, and the matter was referred to the Commissioners of the Western Traffic Association for determination. They have now announced a decision declining to authorize the proposed advance. The decision, which is worthy of record, is as follows:

It appears that at the time of organization of the Trans-Continental Association the west-bound rates for transportation of packing house products from Missouri River points, Mississippi River points and Chicago and common points, were all made uniform, while the west bound rates for other descriptions of freight were adjusted upon a different basis; Mississippi River points being given lower rates than those in force from Chicago, and a still greater reduction being made in the rates from Missouri River points.

The testimony presented at the meeting shows that the price of hogs is higher at the Mississippi River than at the Missouri River, and that at Chicago, and points common therewith, the price is still higher. Under the present adjustment of rates the greater part of the Pacific Coast traffic in this line of business has therefore been enjoyed by the Missouri River packers. Yet it has been possible for packers whose houses are situated further east to compete for at least a share of the business, particularly in cases in which they pack some special brand having a favorable reputation upon the Pacific Coast. It is urged that if to the disadvantage which they now labor under, of being obliged to pay more for their hogs than is paid by their western competitors, there is added the additional disadvantage of being compelled to pay a higher freight rate, the effect will be to drive them out of the Pacific Coast trade, and leave the business in question entirely in the hands of the Missouri River packers. In the opinion of the Commissioners such a result is not desirable.

Pacific Coast dealers may justly claim that they are entitled to a choice of markets in which to make their purchases, while packers engaged in the business at points east of the Missouri River might justly complain if, by the action of the railway companies, they were debarred from doing that share of Pacific coast business which they have for years enjoyed.

While it is true that, as to other forms of merchandise, differences are made in the rates from the various points of shipment, yet it is also true that in other cases the price of the goods is greater in western markets than in eastern markets, the differences in freight rates being no more than sufficient to place the various markets upon a basis of comparative equality. The general object of giving all localities a fair opportunity for competing for the traffic of the Pacific Coast is therefore secured by the present adjustment, and, so far as the trade in hog products is concerned, it would be wholly defeated by the proposed change in rates.

Furthermore, the Commissioners recognize the fact that the present adjustment of trans-continental rates has been brought about by mutual concessions made by opposing interests, with the intention not only of placing shippers upon a basis of equality, as compared with each other, but also of properly protecting the interests of the various carriers and securing a fair division of the business between them. In order to secure this object each line of business has been treated as its special circumstances have seemed to require, and the eastbound rates, for instance, have been adjusted upon a basis radically different from that adopted for westbound traffic.

Several members of the Trans-Continental Association now secure a share of the business in question, which it would be impossible for them to obtain if rates were so adjusted as to concentrate the shipments at Missouri River points, and due regard to their interests seems to require that they should not, by action of the Commissioners, be deprived of that share of the business which was secured by them under the original agreement into which they entered, and which they have for many years enjoyed.

The Commissioners would not feel justified in disturbing an adjustment reached by mutual concession and remaining in force for a long period of years, unless it is clearly proved that the change is imperatively required, and they do not consider that a necessity for the proposed change has been shown in the case under consideration.

Application was recently made to the Commissioners of the Western Traffic Association for a rate of $2.35 per 100 lbs. on cotton bags, carloads, from New York and common points to Pacific Coast terminals, with proportionate rates from more westerly points. They have now rendered a decision, as follows:

It appeared at the hearing of this case that certain eastern manufacturers of cotton bags complained that they are charged the same rate per 100 lbs. for carriage of carload lots of their manufactures to the Pacific Coast that is charged for shipments of smaller lots, while their competitors, the Pacific Coast manufacturers of cotton bags, are given the benefit of a special carload rate for the westbound shipments of cotton bagging, which constitute their raw material.

In the opinion of the Commissioners it is desirable that rates should be so adjusted as not to throw the business exclusively into the hands of the manufacturers of any one section of the country as against all others, and it is especially important that the manufacturing industries of the Pacific Coast should not be crushed out of existence by an unfair adjustment of rates.

The difference now existing between the charges for transportation for two carloads of goods, one consisting of cotton bags and the other of cotton bagging, seems greater than can easily be explained, and yet it is not unreasonable that the raw material should be carried at a cheaper rate than the manufactured product, and the fact that the Pacific Coast bag trade has been divided between the manufacturers of all sections of the country seems to indicate that the present adjustment is established upon a basis that is not far from correct.

Fearing that the granting of the application as made might result in destroying the Pacific Coast industries in this line, and yet believing that it would be well to make at least a moderate reduction in the rates charged for cotton bags in carloads as compared with the rates for smaller lots, the Commissioners decide that a rate of $2.65 per 100 lbs. should be established for the transportation of carload lots of cotton bags from New York and common points to Pacific Coast terminal points, said rate to be graded from western points in the same manner as other rates of $2.65 from New York.

Traffic Notes.

The meeting of the Southern Railway and Steamship Association, which was called for Aug. 17 in Atlanta, has been postponed until Aug. 24.

The roads of the Trans Missouri Association have decided to issue stringent orders that cars when loaded with grain must in every case be filled to their marked capacity.

The railroads in Michigan have made a change in the use of their mileage books by which any member of the purchaser's family may use the book. This change was made to comply with the requirements of a state law which was passed nearly two years ago, but which the railroads ignored until a few weeks ago.

The railroad commissioners of Oregon, who were requested by the Governor to prepare a maximum rate law, have sent him a reply stating that existing rates are reasonable, excepting certain rates on the Southern Pacific, which were ordered reduced by the Board, and are still in effect by reason of the road's refusal to obey the order. The Southern Pacific case has been appealed to the Supreme Court of the state, however.

About two months ago the Erie had a bad wreck near Tuxedo, and many Port Jervis merchants lost goods, some of them to quite an amount. The Erie immediately obtained sworn bills from the merchants and promised a quick settlement, but although two long months have elapsed the Company has not yet settled. Why so long a delay? Is there a fresh supply of red tape on hand in the freight department?—*Port Jervis Gazette.*

Travel to the seashore on Saturday and Sunday, Aug. 13 and 14, was the heaviest of this season. The West Jersey on Saturday sent down to Atlantic City 215 carloads of passengers; to Cape May, Sea Isle City, Ocean City and other points 111 cars. Sunday 116 carloads were carried to Atlantic City and 57 cars to Cape May and other points. The Atlantic City Railroad (Reading system) on the two days transported 447 carloads to Atlantic City.—*Philadelphia Public Ledger.*

The Southern Pacific has announced a material reduction in freight rates from Galveston to New Orleans. On some commodities it is nearly 40 per cent. The through freight rates from San Francisco to points in eastern Washington and western Idaho, over the Southern Pacific and the Union Pacific, have been largely reduced, owing, it is said, to the advent of the new railroad reaching that territory from the east (the Great Northern). The new first class rate to Spokane and other important points is $1.77 as compared with $2.07 by the old tariff. The Northern Pacific has made a reduction of 2½ per cent. on live stock rates from Montana and North Dakota to Chicago. The Union Pacific has made a reduction in the rates on lumber from Oregon to Colorado points, which will go into effect Aug. 25. The new rate on lumber in box cars is 40 cents, a reduction of 10 cents from the existing rate, which continues in force on lumber which is to be loaded on open cars.

The sharp competition in freight rates between San Francisco and New York, which was briefly noted last week, continues to be a topic of discussion. Four large clipper ships have sailed from San Francisco for New York around Cape Horn within six weeks, and the rate on canned goods is reported to have been in some cases as low as $3.50 a ton. It is said that 57,000 tons of freight are now afloat from New York and Philadelphia to San Francisco at $7.00 a ton. A San Francisco dispatch states that the California Traffic Association, or at least members of it, have guaranteed one of the clipper lines against loss in competing with the trans-continental railroads. It is said that the Southern Pacific has determined to make its proposed reduction of 50 per cent. in certain important commodity rates by rail eastward from California without waiting for the authority of the association.

During the week ending Aug. 14,318 carloads, containing 3,818 tons of green fruit, were shipped east from California over the Central Pacific. So far this season, 6,600,000 lbs. more fruit has been shipped than last year.

Eastbound Shipments.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending Aug. 13 amounted to 47,366 tons, against 52,745 tons during the preceding week, a decrease of 5,379 tons, and against 47,675 tons during the corresponding week of 1891, a decrease of 309 tons. The proportions carried by each road were:

Roads.	W'k to Aug. 13		W'k to Aug. 6.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	6,703	14.1	7,389	14.0
Wabash	2,579	5.4	2,926	5.6
Lake Shore & Michigan South.	6,007	12.7	7,209	13.8
Pitts., Ft. Wayne & Chicago	4,177	8.8	4,503	8.5
Pitts., Cin., Chicago & St. Louis	6,412	13.6	6,384	12.1
Baltimore & Ohio	2,976	6.3	2,681	5.1
Chicago & Grand Trunk	3,899	8.2	4,379	8.3
New York, Chic. & St. Louis	4,467	9 3	3,996	7.6
Chicago & Erie	6,562	13.9	6,881	13.0
C., C., C. & St. Louis	3,644	7.7	6,337	12.0
Total	47,366	100.0	52,745	100.0

Lake shipments for the week ending Aug. 13 were 97,171 tons, against 89,183 tons for the preceding week, an increase of 7,988 tons.

GEO. WESTINGHOUSE, JR., President. T. W. WELSH, Supt. JOHN CALDWELL, Treasurer. W. W. CARD, Secretary. H. H. WESTINGHOUSE General Manager.

THE WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH, PA., U. S. A.,

MANUFACTURERS OF THE

WESTINGHOUSE AUTOMATIC BRAKE

The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 24,000 engines and 325,000 cars. This includes (with plain brakes) 232,000 freight cars, which is about 23 PER CENT. of the Entire Freight Car Equipment of this country, and about 80 per cent. of these are engaged in interstate traffic, affording the opportunity of controlling the speed of trains by their use on railways over which they may pass. Orders have been received for 173,000 of the Improved Quick-Action Brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception

Year.	No. per year.	Grand total.
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

E. L. ADREON, Manager. JOHN B. GRAY, Agent. C. C. HIGHAM, General Supt.

THE

AMERICAN BRAKE COMPANY.

NEW YORK OFFICE, 160 Broadway, JOHN B. GRAY, Agent.

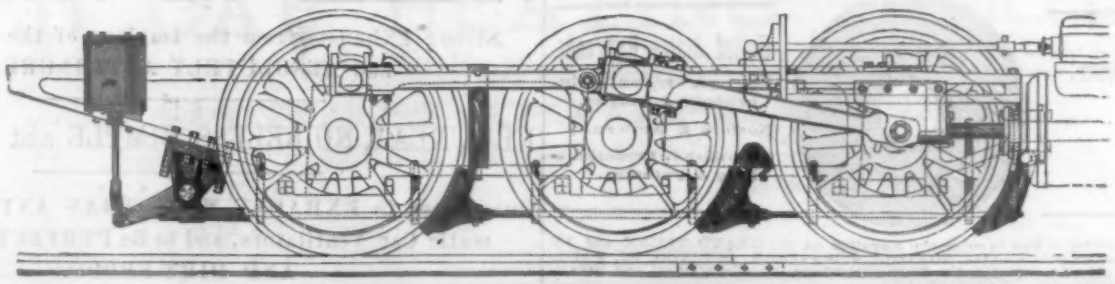
THE WESTINGHOUSE AIR BRAKE CO., Lessee,

MANUFACTURERS OF

CHICAGO OFFICE, GRAND PACIFIC HOTEL.

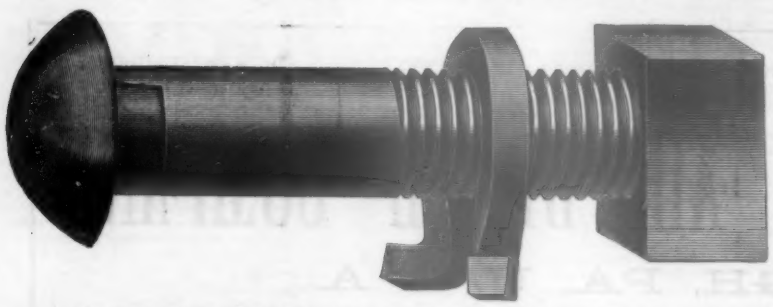
LOCOMOTIVE BRAKES.

General Offices and Shops, Second and Tyler Sts., ST. LOUIS, MO., U. S. A.



Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers furnished to operate with either STEAM AIR or VACUUM.

THE "STANDARD" NUT LOCK



Manufactured under D. O. Ward's Patents by the

STANDARD NUT LOCK CO.,

NOS. 236-248 BANK ST., NEWARK, N. J.

SAMPLES FREE.

This nut lock is presented on its merits as the best and cheapest device for securing track joints.

It is a torsional loop made of good quality of tempered spri g steel, having horizontally inclined foot pieces, which are curved inward, thereby gr atly increasing the spring resistance and acting simultaneously; rests upon the base of angle bar, or underlying rail base in case of fish plate, preventing the loop portion from rotating and hammering down *thread of bolt.*

The nut lock for ⅞ bolt made of ¼ in. square steel, standard pattern, yields a tension of 4,300 lbs. on the bolt, which is sufficient to reduce the wear of the bearing surfaces of the angle bars on the rails, imparting, as it does, a uniform bearing the entire length of the bar.

The "Standard" Nut Lock has sufficient elasticity to maintain a tight joint, which cannot be truthfully said of many light-weight single coil washers.

The "Standard" Nut Lock is, in its superficial form, similar to an annular coil twisted out of plain, *i. e.*, the curved shoulders or ends of the loop proper are spread in the usual manner of spring coils, at which bearing points the locking friction is equal to that of the best single coil washer, and added to this it is terminated in *inwardly curved* extensions, which must apparently furnish additional short leverage spring force of a torsional character.

Distinctive Merits of the "Standard" Nut Lock, Condensed:

Fixedness of position—cannot rotate and hammer down threads of bolt.

Cannot get one end into elongated slot of angle-bar.

Unlike any permanently placed, double washer, the Standard *is* interchangeable regardless of distance between bolts.

Cannot be put on wrong side out, as the outward projection of the foot pieces would prevent the nut being turned up.

Has more spring power directly under the nut than any two ordinary coil nut locks.

Being fixed in position, it offers double the locking friction of nut locks, which when in their *dead* "set" condition turn back with nut by the vibrative effect of passing train.

The "Standard" Nut Lock embodies the old principle of spring power improved by overcoming the objection to the double washer or nut lock, and covering the weak points of the single coil washer.

THE STANDARD COMBINATION TIE PLATE AND BRACE

POSSESSES THE FOLLOWING MERITS:

1. It prevents absolutely the canting of the rail into the tie, thereby greatly increasing the life of the tie.
2. It prevents the rails from spreading or canting over and wearing one side only.
3. The combination of the brace and plate obviates the necessity of spiking the rail and brace separately, thereby saving two spikes and securing the service of the *inside* spike for *holding* the rail; it also prevents the rail from working up and down, and laterally, thus making it impossible to wear the *neck of the spike.*
4. The plate and brace being made of malleable iron, is practically indestructible.

The tie plate and brace is especially useful for curves and guard rails, and also on bridges, whether the rail is laid on ties or on stringers. A tie plate without a brace will not save the head of the spike. A brace without a tie plate will not save the tie, and in a short time the rail will wear into the tie.

P. O. Box 288, PHILADELPHIA, PA. WILLIAM H. PHILLIPS.

Simple. Easily Applied. Very Effective.

THE NATIONAL LOCK WASHER

THE ONLY POSITIVE NUT LOCK IN COMBINATION WITH ELASTICITY.

Sixty Millions in Use in Railroad Track.

For Use on All Kinds and Classes of Work.

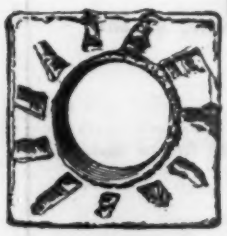
Made for all sizes of bolts.

A trial is requested.

Samples free of expense.

THE NATIONAL LOCK WASHER CO, Newark, N. J.

THE AMERICAN WASHER & MANUFACTURING CO.



EDWIN W. HINE, President. L. L. STURGES, Secretary and Treasurer. H. A. HARVEY, Vice-President.

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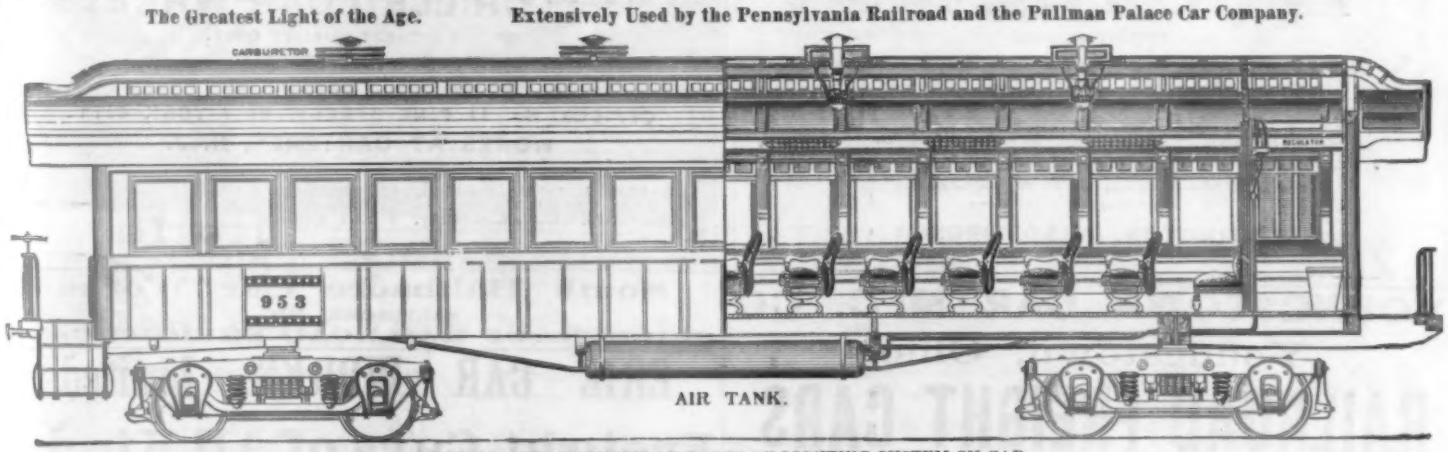

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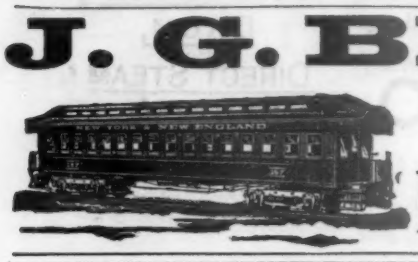
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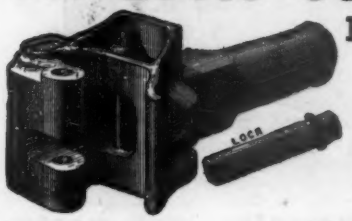

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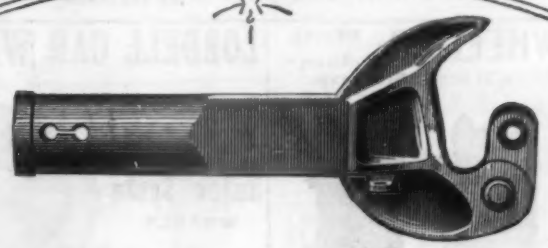

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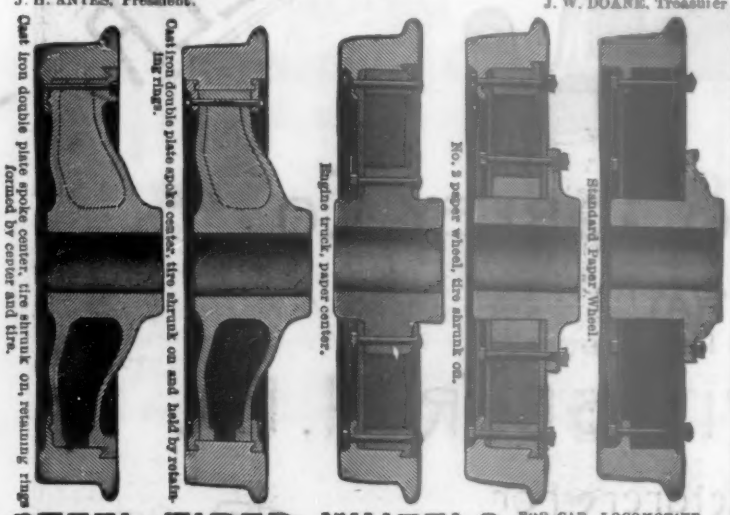
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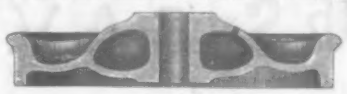

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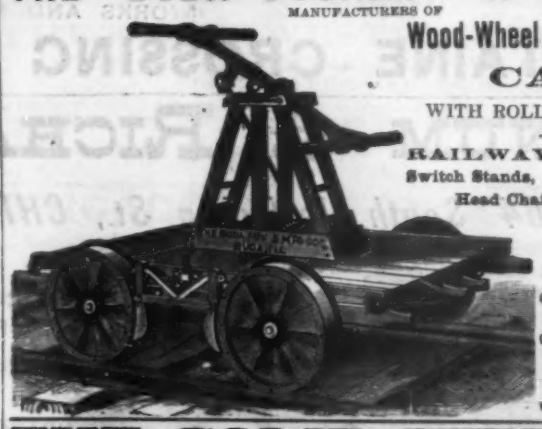

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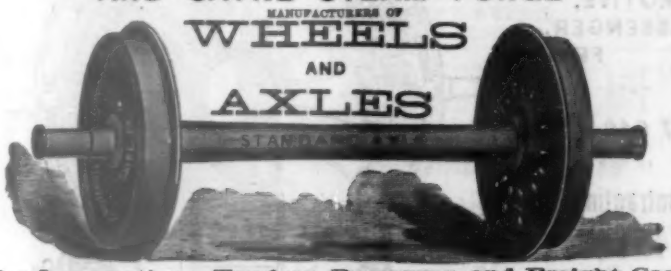

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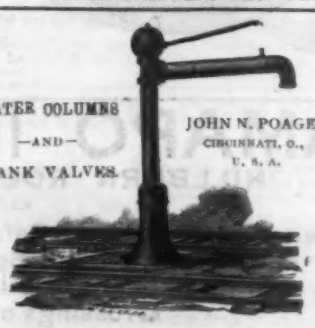

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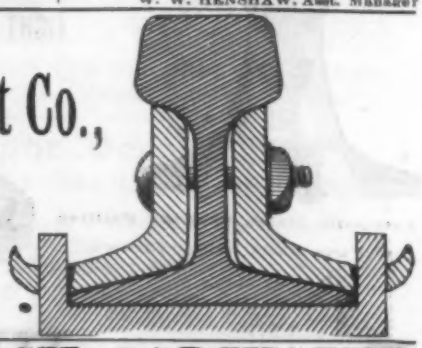

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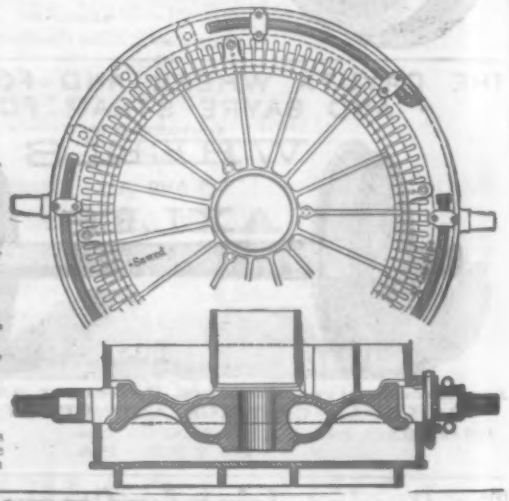

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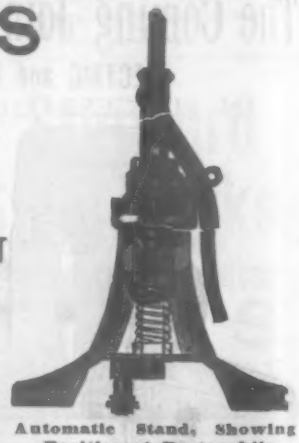

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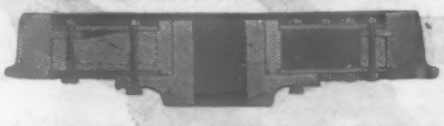

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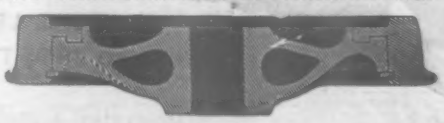

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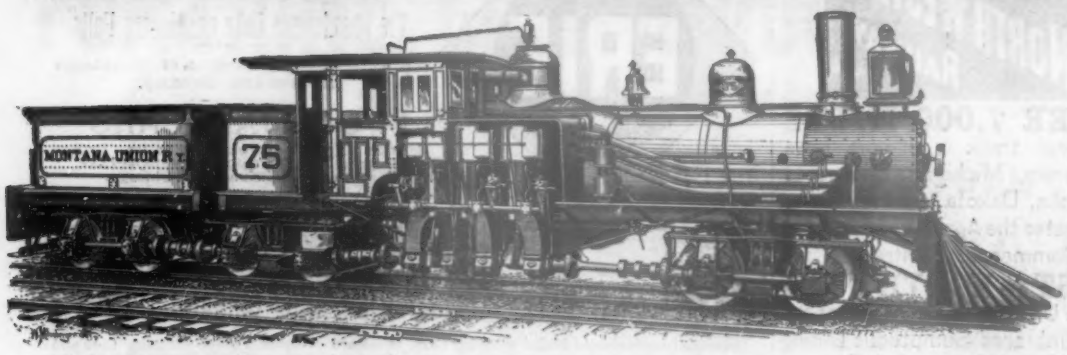

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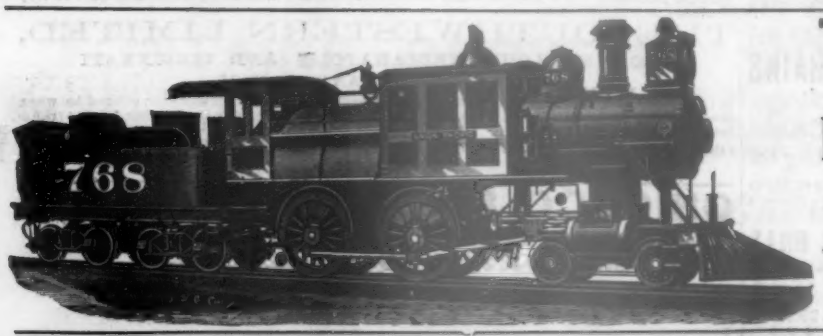

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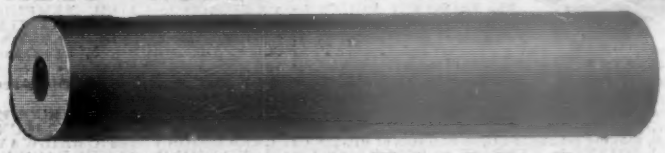

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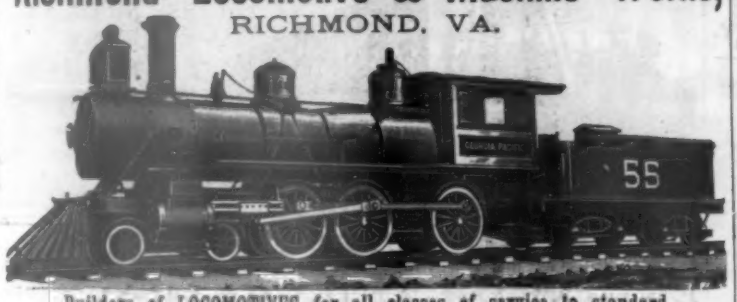

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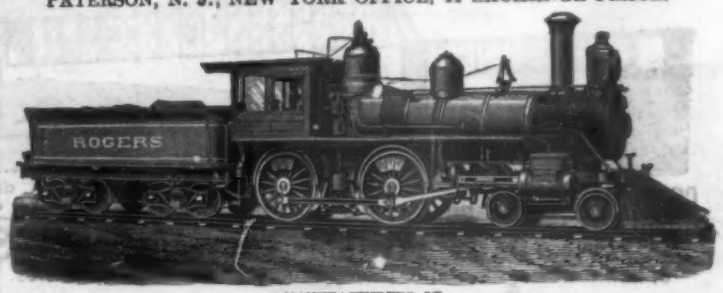

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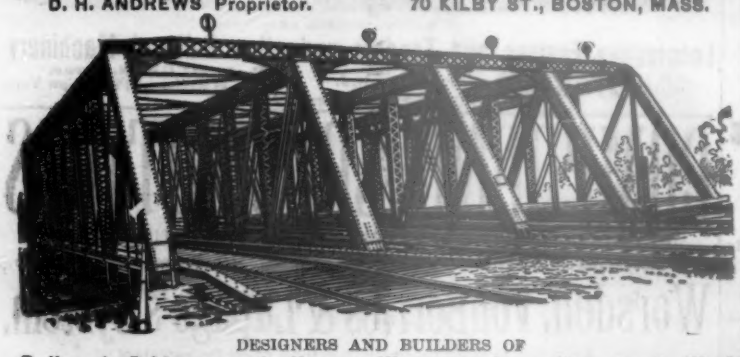

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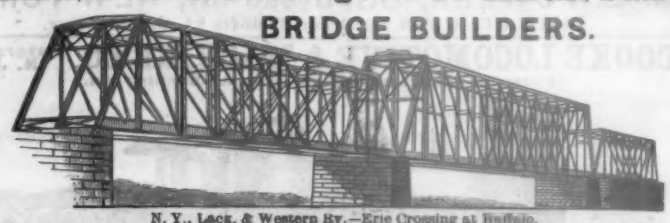

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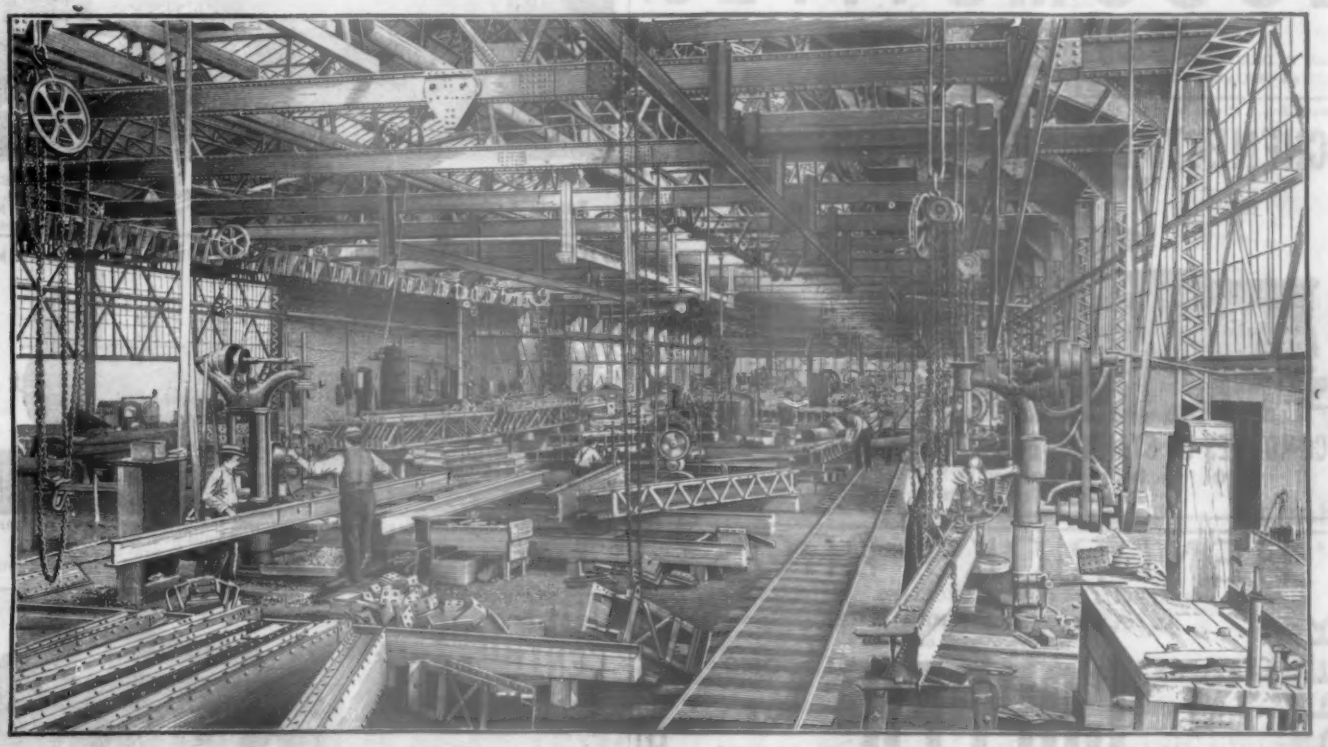

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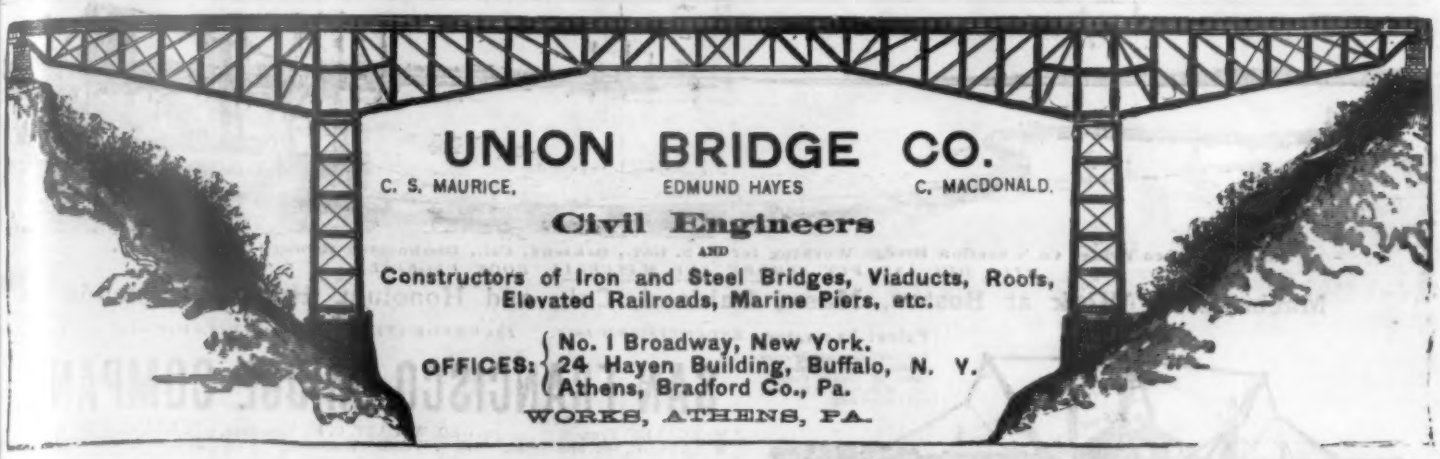

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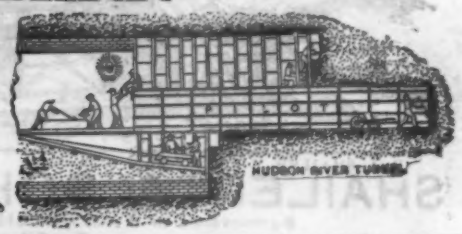

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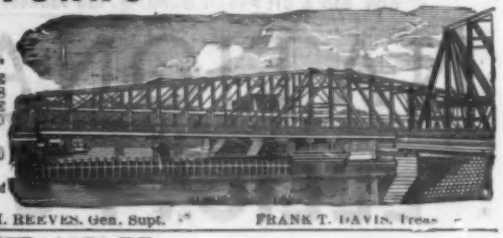

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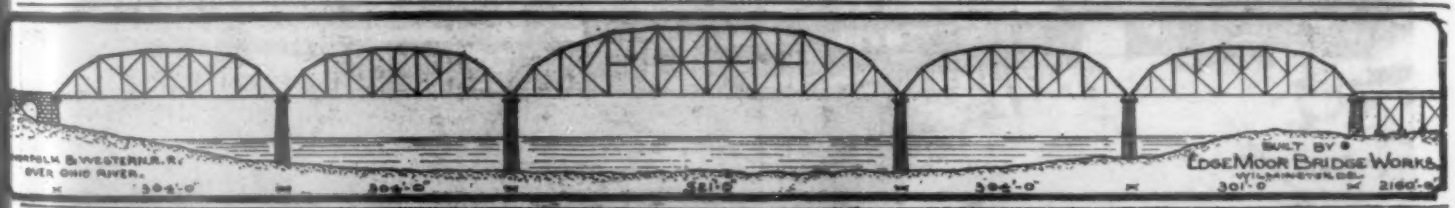

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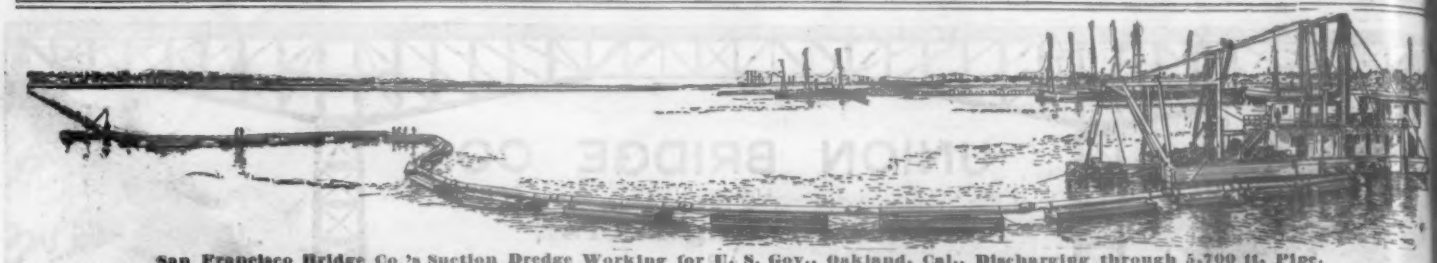

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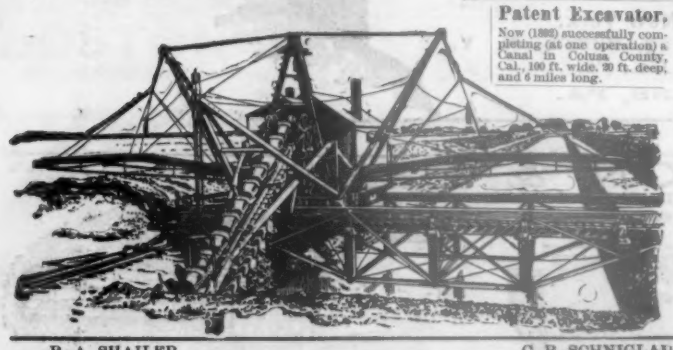

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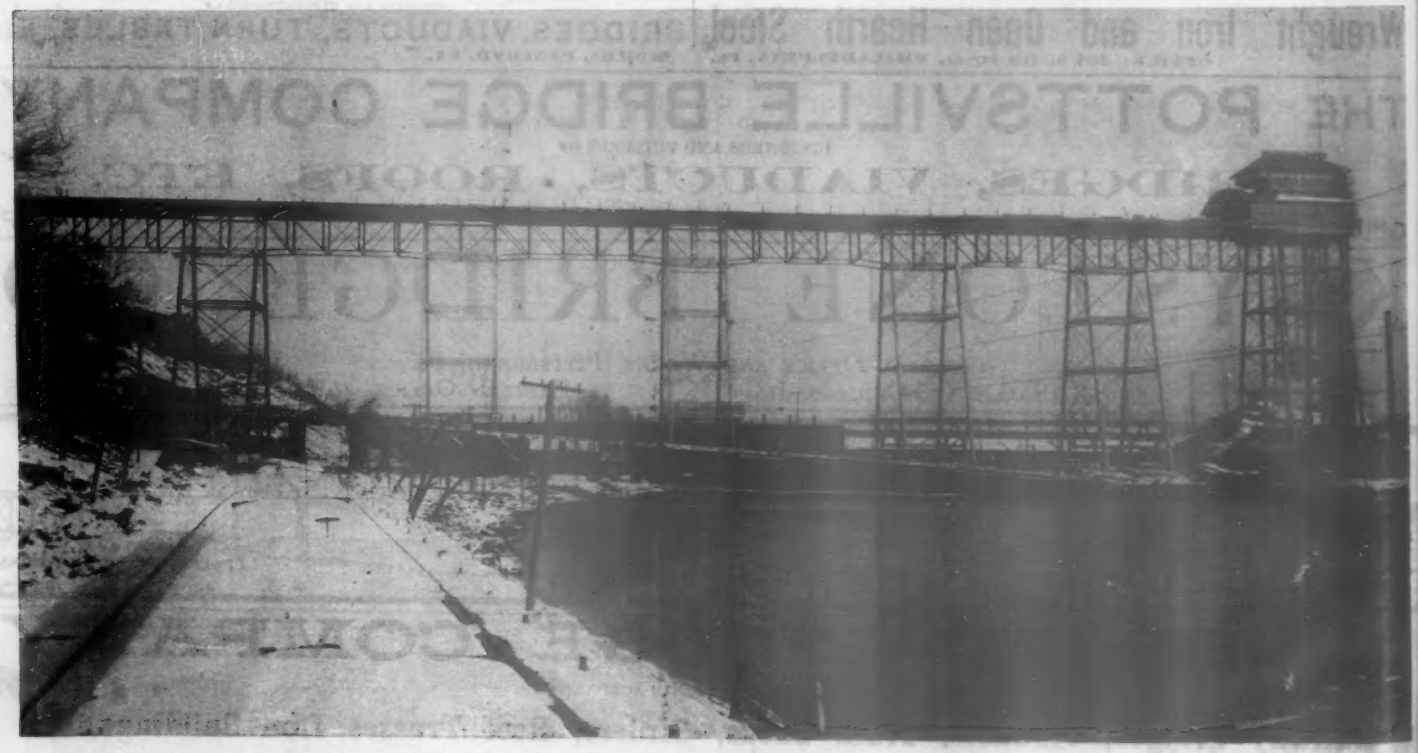

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*Subject to countermand.

			H. P.
Rio Grande Smelting Works,	4th order,	Socorro, N. Mex.,	45
S. D. Warren & Co.,	25th "	Cumberland Mills,	35
Westinghouse Machine Co.,	18th "	Pittsburgh, Pa.,	35
Dunnell Mfg. Co.,	42d "	Pawtucket, R. I.,	35
St. Nicholas Building,	1st "	Pittsburgh, Pa.,	25
Chicago & N. W. R'y Co.,	3d "	Chicago, Ill.,	25
Westinghouse Air Brake Co.,	29th "	Wilmerding, Pa.,	25
C. G. Boult,		Ahnapee, Wis.,	25
East End Electric Light Co.,	23d "	Pittsburgh, Pa.,	15
James Stewart & Co.,		St. Louis, Mo.,	15
St. Nicholas Building,	2d "	Pittsburgh, Pa.,	10
Rich Electric Heating Co.,		Mt. Vernon, N. Y.,	10
Crane & Co.,	3d "	Dalton, Mass.,	10
Morris Machine Works,	7th "	Baldwinsville, N. Y.,	10
West End Street R'y Co.,		Boston, Mass.,	5

Total, 31 Engines, aggregating 1,845

JUNIOR ENGINES.

			H. P.
Pencoyd Iron Works,	12th order,	Pencoyd, Pa.,	50
R. F. Stoner,		Bellwood, Pa.,	50
Macatawa Park Association,		Holland, Mich.,	35
R. F. Livengood,		Delavan, Minn.,	35
Eagler & Handke,		Bristol, S. D.,	35
Franklin Glazier & Son,		So. Glastonbury, Conn.,	35
M. B. Potter & Co.,		Hitchcock, S. D.,	35
John L. Ominger,		Amsterdam, N. Y.,	25
Agent,		Sydney, Australia,	25
David Bradley Mfg. Co.,		Chicago, Ill.,	25
Whitall, Tatum & Co.,	5th order,	Millville, N. J.,	25
Pencoyd Iron Works,	13th "	Pencoyd, Pa.,	25
Agent,		Sydney, Australia,	15
Jackson Pulp Co.,	2d order,	Jackson, Mich.,	10
Texas Elevator and Compress Co.,		Dallas, Tex.,	10
Agent,		Sydney, Australia,	10
Albert Hermann,		Paris, France,	10
Jules Senn,		Lyons, France,	10
Agent,		Paris, France,	10
Fontaine Crossing Co.,	5th order,	Detroit, Mich.,	5
Crystal Ice Co.,		Youngstown, O.,	5

Total, 21 Engines, aggregating 485

Grand Total for July ..... 71 Engines, aggregating 5,810 H. P.

RONEY MECHANICAL STOKER--Recent Orders.

			Stokers.
Carnegie Steel Co.,	10th order,	Pittsburgh, Pa.,	16
Baltimore City Pass. R'y Co.,		Baltimore, Md.,	14
Joliet Enterprise Co.,	3d "	Joliet, Ill.,	12
Westinghouse Air Brake Co.,		Pittsburgh, Pa.,	12
Cheney Bros.,		So. Manchester, Conn.,	8
Pittsburgh Plate Glass Co.,	5th "	Pittsburgh, Pa.,	8
Allegheny County Light Co.,	3d "	Pittsburgh, Pa.,	8
Kerr Thread Co.,	"	Fall River, Mass.,	7
Paige Tube Works,		Cleveland, O.,	6
Niagara Falls Paper Co.,		Niagara Falls, N. Y.,	5
Linden Paper Co.,		Holyoke, Mass.,	4
National Ice Milling Co.,		New Orleans, La.,	4
Chicago Cold Storage Exchange,		Chicago, Ill.,	4
Rumford Falls Paper Co.,		Rumford Falls, Me.,	3
Otis Falls Pulp Co.,		Otis Falls, Me.,	3
Decatur Gas Light Co.,	3d order,	Decatur, Ill.,	2
Pittsburgh Water Works,		Pittsburgh, Pa.,	2

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A. J. FARLEY, Secy.
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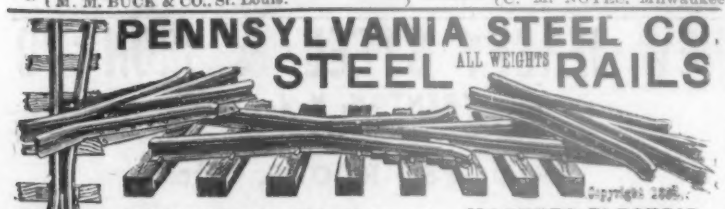

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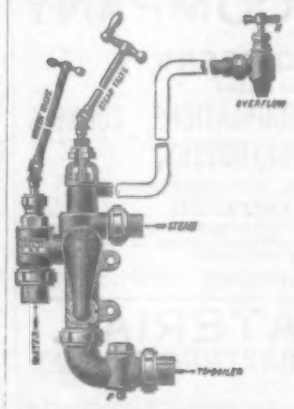

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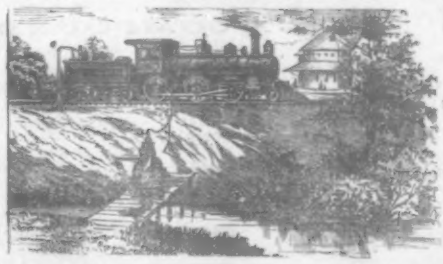

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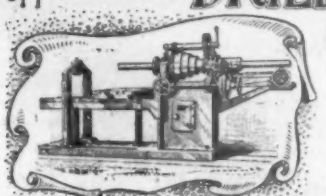

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